SOUTHEASTERN BIOLOGY



ASB

ASB

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ASB ASB 75TH ANNUAL MEETING ASB

APRIL 2-5, 2014

Converse College

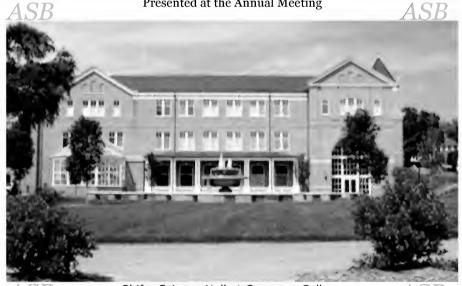
ASB Spartanburg Community College
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University of South Carolina Upstate

Wofford College

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Abstracts of Papers and Posters Presented at the Annual Meeting



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SOUTHEASTERN BIOLOGY

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News items should be sent to the News Editor. Send books to be reviewed to the Book Review Editor.

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PURPOSE

The purpose of this association shall be to promote the advancement of biology as a science by encouraging research, the imparting of knowledge, the application of knowledge to the solution of biological problems, and the preservation of biological resources. The ASB has representation in Section G Committee of the AAAS. Varying types of membership are available to individuals and institutions. See inside back cover.

TIME AND PLACE OF FUTURE MEETINGS

2015 April 1-4: Hosted by the University of Tennessee at Chattanooga. Meeting site is the Convention Center at the Marriott.

ASSOCIATION OF SOUTHEASTERN BIOLOGISTS INTERIM EXECUTIVE COMMITTEE MEETING 14-15 SEPTEMBER 2013 CHATTANOOGA, TENNESSEE

ATTENDANCE: 12 persons attended the meeting.

NAMECAPACITYZack MurrellPresidentJoey ShawVice PresidentTim AtkinsonTreasurerJohn HerrArchivist

Bill Ensign EC Member-at-Large Conley K. McMullen EC Member-at-Large

Ashley Morris Web Editor
James Caponetti Journal Editor

Patricia Cox Past-President's Council Representative
Wayne Van Devender Chair, Meritorious Teaching Award Committee

Terry Richardson Chair, Publications Committee
Kirk Stowe Chair, Education Committee

I. Call to Order and Welcome

President Zack Murrell called the Executive Committee (EC) Meeting to order at 9:05 A.M. Zack welcomed everyone in attendance, and asked each individual to share one goal that he/she hoped to address at this meeting.

II. Approval of the Executive Committee Meeting Minutes

President Zack Murrell pointed out one correction to the minutes of the 13 April 2013 EC Meeting. A brief discussion on quorum followed, as only five voting members were present at the meeting. Presidential action was suggested so that the meeting could move forward. Zack determined that we would go forward with five voting members.

<u>Motion 1</u>. Terry Richardson made a motion that the minutes of the 13 April 2013 EC Meeting, as corrected, be approved. Bill Ensign seconded, and the motion carried.

III. Reports from Officers, EC Members, and Appointed Position Chairs

- A) **President** Zack Murrell gave a presentation on the current state of ASB that spanned a variety of topics.
- B) Vice-President Joey Shaw reported that he has arranged for Henry Wilbur (UVA) to be the plenary speaker at the upcoming meeting in 2014 in Spartanburg, SC. Rebecca Cook and Howie Neufeld are looking into potential speakers for the 2015 meeting.

- C) Secretary Sarah Noble (no report).
- D) Treasurer, Business Manager Tim Atkinson presented an overview of our organization's current tax status (501C3 status was revoked by IRS). Options for going forward were presented: 1) pursue reinstatement, 2) go forward as a for-profit organization (we would then owe taxes), 3) cease operations. Discussion followed. In May 2013. Tim discussed our options with Tax Resolutions Services. If we decide to pursue reinstatement, we would need to contract with TRS. Our current situation began when we failed to file Form 990. More discussion followed. If pursuing reinstatement, we would need to prove that we have maintained compliance. The IRS would want a list of all current officers/spouses and all former officers/spouses, as well as all financial information of officers. If we choose to go forward as for-profit, we would owe at least \$104,311 (worst case scenario). We would need to increase our registration fees to pay taxes if we go forward as for-profit. Perhaps we will need to hire an attorney, Archivist John Herr suggested contacting the regional IRS officer face to face before hiring an attorney. Tim Atkinson agreed, Tim thanked President Zack Murrell for his support during this process.

Tim reviewed the fiscal year 2012 finances with the EC via spreadsheet. Discussion followed regarding specifics of the report. The figures showed an ending balance of \$65,567, and a net increase of \$9,012 from 2012.

- E) Archivist John Herr (archivist), Ken Shull (associate archivist), and Virginia Davis (assistant archivist) visited the ASB archives in Athens, GA on 6 September 2013. Included among the items left with the archives was the ASB Book of Fellows with the signature of our most recent Fellow, Peter Raven. John mentioned that the trip had been a good experience for all involved.
- F) **Print Editor** Jim Caponetti mentioned that he will need to remove the statement of tax exempt status from *Southeastern Biologist* (SEB). Jim notified the EC that Cengage, one of our sponsors, has entered Chapter 11 status. Discussion followed. Patricia Cox complimented Jim on the October 2013 issue of SEB. Discussion followed regarding the status of an invited research paper. Jim requested specific information on the dates and host(s) of the 2016 meeting for posting. Zack Murrell affirmed that this info would be available for the January issue of SEB.
- G) Web Editor Ashley Morris reported that she had updated the website information on officers and committees, and that the October 2013 issue of SEB had been posted. Ashley also informed the EC that information on the 2014 meeting was now available online. Discussion followed regarding what additional information should be posted regularly. This discussion will continue at the strategic planning meeting on Saturday.
- H) Book Editors Jennifer Mandel and Chris Brown (no report).
- News Editor Ricky Fiorillo (no report).

- J) Past President's Council Donald Roush (no report).
- K) Membership Officer Sarah Noble Written report circulated. Membership numbers continue to be in decline. Discussion followed. Library membership disappeared when we went online. Deceased member - Timothy J. Motley; Emeritus Request - Charles D. Humphrey.
- L) Meetings Coordinator Scott Jewell Written budget on Charleston, WV (2013 Final) and Spartanburg, SC (2013 Anticipated) meetings were circulated and discussed.

IV. Committee Reports

- A) AMAC 2014 Zack Murrell outlined committee assignments, and reported that contracts had been signed for this meeting. There will be four featured institutions, Converse College, University of South Carolina Upstate, Spartanburg Methodist College, and Wofford College.
- B) AMAC 2015 Zack Murrell outlined committee assignments, and reported that contracts had been signed for this meeting. UT Chattanooga will be the featured institution.
- C) AMAC 2016 Zack Murrell outlined committee assignments. Contracts have not yet been signed, but the meeting will take place in Concord, NC. One potential featured institution (Queens University) has indicated an interest in assisting with this meeting. Discussion followed regarding contracts (who should sign) etc.
- Bioinformatics Committee Zack Murrell reported that this committee has run its course and will be dissolved.
- E) Conservation Committee Written report circulated (Jeffrey Ray).
- F) Education Committee Written report circulated (Chris Havran and Kirk Stowe).
- G) Finance Committee no report.
- H) Graduate Student Support Grant Written report circulated (Lisa Kelly). Discussion followed regarding the amount of funds available for this award.
- 1) Committee on Human Diversity no report.
- J) Member Benefits Committee no report.
- K) Meritorious Teaching Award Committee Wayne Van Devender circulated a written report. There were three nominations for this award, and Kim Marie Tolson was selected as the winner in 2013.

- L) Nominating Committee no report.
- M) **Poster Award Committee** Written report circulated (Jennifer Boyd), including a new rubric for evaluating posters.
- N) Program Committee no report.
- O) Publications Committee Terry Richardson reported on the committee structure. Zack Murrell raised a question as to whether the Web Editor should be a permanent member of this committee. This issue will be addressed at a future date. Discussion followed on the relationship between ASB and Eastern Biologist, as well as on the general duties of the Publications Committee.
- P) Research Awards Committee (Senior) Written report distributed (John L. Carr). Issues were discussed with two changes to the bylaws recommended by the committee. The EC decided to discuss this under New Business.
- Q) Research Awards Committee (Student) Written report distributed (John Quinn). Discussion followed regarding potential members of this committee.
- R) Research Awards Committee (Microbiology) Written report circulated (Lisa Ann Blankenship).
- S) Resolutions Committee no report.
- T) Tri-Beta no report.

V. Old Business

- A) Resolving longstanding issues regarding strife in our Association Web Editor Ashley Morris stated that we should address this now. Discussion followed.
- B) Tax Status President Zack Murrell opened the floor for solutions to this problem. Discussion followed. Archivist John Herr will head an ad hoc committee to consider our status. John and Treasurer Tim Atkinson will contact the IRS.

VI. New Business

A) Report from the Ad Hoc Committee on ASB Finances 2000-2013 - The EC reviewed a spreadsheet outlining ASB finances during the past ten years. This spreadsheet was compiled by committee members Rebecca Cook, Tim Atkinson, and Conley McMullen (Chair). Discussion followed. President Zack Murrell asked that the Ad Hoc Committee continue to develop their report, to ultimately be provided to the ASB EC and Past Presidents. A scaled down version will be provided to the membership.

- B) Financials reports and details what do we need to provide to the membership? Members of the EC discussed these questions. The Ad Hoc Committee on ASB Finances will finish its work and make recommendations (graphs) within two months.
- C) Needed changes to constitution and bylaws Web Editor Ashley Morris will chair an Ad Hoc Committee to reconcile the constitution, bylaws, and leadership guide. John Herr and Ed Lickey will be members of this committee.
- D) Proposals for Workshops and Symposia at the 2014 meeting:
 - 1. PULSE Vision and Change Symposium Written description circulated. Discussion followed. President Zack Murrell had given tentative approval to the southeastern PULSE Fellows (at a meeting in Atlanta, Georgia August 10 &11) that we will partner with PULSE on a symposium and workshop.
 - 2. PULSE Vision and Change Workshop Written description circulation. Discussion followed. The proposal did not seek ASB funds, but they are seeking NSF funds to support the symposium and workshop.
 - Motion 2. Journal Editor Jim Caponetti made a motion to approve support for the PULSE symposium and workshop. Bill Ensign seconded the motion, and the motion carried.
 - 3. Education Committee Field Station Symposium Kirk Stowe outlined plans for a symposium. Six or seven speakers have been recruited for this. There will be no cost to ASB.
 - <u>Motion 3</u>. Motion made to support the Education Committee's symposium. The motion was seconded and carried.
 - 4. Natural Disturbances and Range of Variation Written description by C.H. Greenberg and Beverly Collins circulated. Discussion followed.
 - Motion 4. Bill Ensign made a motion to accept the symposium topic. Vice-President Joey Shaw seconded. Discussion followed. The motion carried.
 - Motion 5. Conley K. McMullen made a motion to approve \$3500 to support the symposium. Bill Ensign seconded. The motion did not carry.
 - The EC requests that it be informed by Katie Greenberg and Beverly Collins before the end of November as to whether the symposium will advance without funding from ASB.
- E) John Herr Award nominee President Zack Murrell announced that we have a nominee. Zack asked Patricia Cox to Chair the committee to vet

this nominee and will ask Kim Marie Tolson and Michael Dennis to serve on the committee.

- F) Tri-Beta Lee Sutton (District 2) is now our contact person. Lee requested better interactions between ASB and Tri-Beta in the future. Discussion followed.
- G) Computer upgrade Our computers need software upgrades. President Zack Murrell expressed concern about whether they can be upgraded to Windows 7, and requested that this be checked. Discussion followed. Zack asked Tim Atkinson to check on this.
- H) Partnering societies and affiliates (how to improve relationships) -Tabled.
- Form for ASB Emeritus status application This topic was discussed. Tim Atkinson and Zack Murrell will work on this form. The EC agreed to this strategy.
- J) Wikipedia description for ASB? President Zack Murrell stated that Susan Farmer had agreed to create an ASB page if provided with information. Discussion followed and the EC agreed to seek Susan Farmer's assistance in developing a presence on Wikipedia, an online encyclopedia. Ashley Morris will provide Susan with the necessary information.
- K) Bylaws change for Treasurer Position John Herr proposed the idea of establishing a Treasurer's Office. Discussion followed.

Motion 6. John Herr made a motion to change the ASB bylaws to reflect the establishment of a Treasurer's Office comprised of a Treasurer and Associate Treasurer. Tim Atkinson seconded. ASB membership will need to vote on this. Discussion followed. The motion carried.

Bill Ensign moved to recess until tomorrow at 8:30 AM. Joey Shaw seconded. The motion carried.

The ASB EC Meeting Reconvened at 8:40 A.M. on 15 September 2013.

The first order of business was to continue discussion of a Treasurer's Office.

<u>Motion 7</u>. Tim Atkinson moved that we edit the description of the Treasurer's Office as advised by the EC. Bill Ensign seconded. Discussion followed. The motion carried.

<u>Motion 8</u>. Joey Shaw moved that we accept the edits mentioned in Motion 7. Jim Caponetti seconded. Discussion followed. The motion carried.

L) Senior Research Award changes - The EC advised that we simply follow the guidelines already in existence.

- M) Poster Award The possibility of having two awards, one for graduate and one for graduate students was discussed. Terry Richardson pointed out that the current poster award description does not specify graduate or undergraduate, so either may apply. Discussion followed. The EC will continue considering the idea of two awards, and will discuss this further during Strategic Planning meeting later in the day.
- N) Annual Meeting Topics A discussion of CVENT took place, focusing on the question of database ownership. Also discussed were questions regarding access, appropriateness for ASB, and cost benefit to ASB. Tim Atkinson reported on the history of CVENT with ASB, current functions, and current expenses (\$7050/year). Discussion followed.

Motion 9. Patricia Cox moved that Zack Murrell sign a ten-year contract with CVENT (seven years remaining at this date). Joey Shaw seconded. Discussion followed. The motion carried.

A2Z - President Zack Murrell summarized Scott Jewell's relationship with ASB. Discussion followed. Zack tasked an Ad Hoc Committee (Terry Richardson, Joey Shaw (Chair), Zack Murrell) to discuss contract negotiations with A2Z.

Discussion of PULSE-Spartanburg Operating Plan - President Zack Murrell shared information regarding the cost of hosting the PULSE symposium in Spartanburg. Discussion followed regarding benefits to PULSE and ASB respectively.

President Zack Murrell charged the Finance Committee with building an effective interface between ASB and A2Z (Scott Jewell) to 1) deal with annual meeting budget specifics, 2) obtain data to help the EC evaluate a potential contract between A2Z Services and ASB to assist in hosting the PULSE Workshop and Symposium at the 2014 meeting, and 3) determine a method of performance review for the Meeting Planner. Murrell charged the Finance Committee with providing financial information to the EC as soon as possible to allow the EC to evaluate a partnership with the PULSE Fellows in pursuing funding from the National Science Foundation..

VII. Announcements

There were no additional announcements.

VIII. Adjournment

Being no further business, Conley McMullen made a motion to adjourn, and Jim Caponetti seconded. President Zack Murrell adjourned the meeting at 12:00 P.M.

Respectfully submitted,

Conley K. McMullen 16 September 2013

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ASSOCIATION OF SOUTHEASTERN BIOLOGISTS 75th ANNUAL BUSINESS MEETING FRIDAY 04 APRIL 2014 SPARTANBURG, SOUTH CAROLINA

- Call to Order and Welcome President Zack Murrell called the meeting to order at 12:07 P.M. and welcomed all members.
- 2. Approval of the Minutes The 2013 Business Meeting as published in the July 2013 issue of *Southeastern Biology*. A motion to accept the minutes as published was made, seconded, and approved.
- Election of Officers -Candidates were introduced. There was a call for further nominations from the floor and, being none, it was moved that the nominations close. Tellers distributed the ballots and members voted.
- Recognition of Members Who Passed in 2013-2014 President Murrell asked for a minute of silence to pay our respects to them.
- Treasurer's Report Preliminary Treasurer's Report was given by Ed Lickey. ASB has money, and four bank accounts. The Silent Auction made money, thanks to Pat Cox and the Sisters. Tee-shirt sales were also good.
- **6. Enrichment Fund Report** Mike Dennis gave the Enrichment Fund Report. We are holding off on promoting it due to two factors. 1) Changes in Treasurer/accounting and, 2) IRS reinstatement as a non-profit.
- Members Requesting Emeritus Status Charles D. Humphrey sought emeritus status. A motion to grant emeritus status was made, seconded, and passed.
- 8. Resolutions Past President Patricia Cox, Chair of the Resolutions Committee, read the "Resolution of Appreciation to the business meeting audience and the Organizers of the 75th Annual Meeting of the Association of Southeastern Biologists." A motion by the Resolutions Committee to accept this resolution was passed.
- 9. Proposed Changes to the Bylaws and Constitution Reviewed by the Executive Committee during their September meeting. Office of the Treasurer is to be restructured. Results will be published in the January issue of Southeastern Biologist.

The floor was opened to questions.

- 10. Announcements Location for pre banquet social was announced. This year's Silent Auction raised \$3165. There were 743 registrants for this meeting.
- 11. Adjournment Business Meeting was adjourned 12:35 P.M.
- 12. Election Results Announced at the Friday evening Awards Banquet.

President-Elect – Joey Shaw Vice-President – Ashley Morris Treasurer – Ed Lickey Members-at-Large – Peggy Kovach and Ricky Fiorillo

Respectfully submitted, Sarah M. Noble, Secretary 2013-2015 04 April 2014

AST Environmental

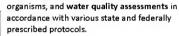
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Call for Proposals 243

CALL FOR NON-COMMERCIAL WORKSHOP AND SYMPOSIUM PROPOSALS FOR THE 2015 ANNUAL MEETING OF THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

Deadline for Receipt of Proposals: September 1, 2014

Proposals for non-commercial Workshops (hereafter referred to as Workshops) and Symposia to be offered at annual meetings of the Association of Southeastern Biologists must be prepared and submitted for review as described in this Call for Proposals; the same criteria for proposal preparation, submission, and review apply to proposals originating from internal leadership bodies within ASB (such as standing committees) and from individuals or groups outside of ASB. Commercial workshops are arranged through the Meetings Coordinator, and they are subject to separate guidelines that can be obtained from the Meetings Coordinator. Written proposals for Workshops and Symposia must be submitted to the Chair of the Program Committee, the ASB Meetings Coordinator, and the ASB President no later than two weeks prior to the fall interim meeting of the ASB Executive Committee. Proposals for Workshops must clearly describe their structure (including maximum number of participants) and concept, as well as prerequisites, space and other facilities requirements, and request for funding from ASB (if any). Proposals for Symposia must clearly address all five of the criteria listed below and be accompanied by letters of endorsement (if any). All proposals will be peer-reviewed and ranked by the Program Chair of the LAC and the ASB Executive Committee. Decisions to accept or reject proposals will be made at the fall interim meeting of the ASB Executive Committee, and proposers will be contacted shortly thereafter.

Workshops

Structure & Concept: Workshops are flexible in their structure. They can be a halfday, full day, or two days in length. Lunchtime Workshops are also offered. Workshop structure is determined by the organizers. Workshops typically have maximum enrollments, and they may specify prerequisites for participation (Workshops should be open to all meeting attendees, first-come first-served, who meet these prerequisites). Workshops often have a registration fee to cover A/V equipment and preparation. Workshops are intended to convey specific knowledge or skills; they are not intended for the presentation of research papers. Workshops are frequently more interactive and informal than sessions within the formal scientific program, and they are not scheduled concurrently with Symposia, contributed oral sessions, or poster sessions. Workshops may involve one or several teachers/presenters, and they may include computer-based or other 'hands-on' training. Weekend Workshops may be linked with a scientific field trip. A Workshop proposal should make clear what participants might expect to gain, and how the Workshop furthers the overall goals of the Association of Southeastern Biologists (these two aspects are the major criteria for Workshop acceptance). Limits of space and time may make it impossible to accommodate all worthy submissions.

Symposia

Structure & Concept: Symposia are a half-day or a full day in length. The number of speakers and the length of each talk are determined by the session organizers; talks should be between 15 and 30 minutes long, and presentation times can vary between speakers. Each session should include at least one 30 minute break that will be synchronized with the coffee break of all concurrent sessions. Generally, Symposia should be focused, integrated presentations assessing current understanding regarding a particular research problem, concept, application, or educational theme. Symposia should have broad appeal to members of ASB or involve integration across sub-disciplines.

Symposium proposals will be assessed under the following criteria. Weighting of particular criteria may vary depending on the nature of proposals, but proposals should explicitly address these criteria, as appropriate. There is typically room for only three Symposia at the annual ASB meeting.

Criteria for Evaluation of Symposium Proposals

- Scientific strength: Symposia are the scientific centerpieces of the meeting, and should:
 - offer significant contributions to biological understanding,
 - present innovative or interdisciplinary approaches, including novel collaborations or syntheses across subdisciplines, and
 - have broad enough appeal to generate large audiences (>100 people) at the meeting.
- Structure and organization: Symposia should be more explicitly integrated than other sessions, and should be structured to:
 - provide overall synthesis or overview; they should not be simply a set of related case studies,
 - avoid taking a narrow perspective on the Symposium topic; organizers should carefully avoid appearance of biases toward their own perspectives, and
 - build a well-integrated whole; each talk should have clear relevance to overall synthesis.
- Speakers: Invited speakers should bring new contributions to the session, not simply reviews of previous work. Inclusion of experienced or particularly engaging speakers can strengthen a proposal, but new voices are also important. Proposals with a larger proportion of confirmed speakers will be favored.
- 4. Funding: Workshop and Symposium proposers must certify that they have sufficient funding available to cover all costs of the program <u>as proposed</u>, including expenses (travel, meals, lodging, honoraria) for all invited speakers. If additional funds are needed beyond those available to the proposers, such funds must be identified and may be requested from the ASB Executive Committee (EC), which has some funding available for Symposium proposals, usually reserved for proposals that come from ASB standing committees. If requesting funds from the EC, the Symposium proposers must specify an amount and justify that amount. If the EC provides funds requested by the Symposium proposers, it is assumed that the Symposium is fully funded as described. If partial funding is offered by the EC, the Symposium proposers must subsequently secure the additional funds required to cover all costs.
- 5. **Integration:** Proposals may receive higher priority if they are clearly linked to the meeting's overall theme, or if they offer particular value or insight in the

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context of other sessions proposed for the meeting or of Symposia at recent ASB meetings.

Endorsements

Workshops and Symposia are often endorsed by various groups, agencies, and organizations including international societies, private non-governmental organizations, governmental agencies, or internal leadership bodies within ASB, such as standing committees. These endorsements will be considered in review of proposals, particularly if they emphasize why the group finds merit (in terms of evaluation criteria above) in the proposal. Each of these groups, organizations, or agencies is allowed to endorse only one Symposium proposal. If a group submits a proposal, that group is considered to be endorsing its own proposal, and it cannot endorse another. Symposium proposers, in requesting endorsements, should make this policy clear. There is NO guarantee that a proposal endorsed by any group or organization will be accepted. Individuals preparing letters of endorsement should send them directly to those preparing the proposal for inclusion as part of the proposal package.

If Your Proposal Is Accepted

After proposals are accepted and the scheduling for the meeting is underway, cancellations and schedule changes are very disruptive to meeting planning. Hence, organizers of Workshops should obtain firm commitments from their teachers/presenters and organizers of Symposia should obtain firm commitments from as many of their invited speakers as possible before submitting their proposals. Requests for additional funding will not be considered by the ASB Executive Committee.

If a proposal is accepted, the organizers must submit a final summary description of the Workshop or Symposium to the Program Committee Chair at the same time abstracts are due. This summary will appear on the meeting website and should be written so as to stimulate interest and promote attendance. This description must include a complete and current listing of organizers' names and their affiliations, addresses, telephone and fax numbers, and email addresses; a 400-word narrative description of the session; a 50-word sentence description of the session; and a final, confirmed speaker list.

It is the responsibility of Symposium organizer(s) to see that each speaker submits an individual abstract of his/her talk using ASB's abstract submission criteria by the abstract submission deadline. It is not permissible to submit abstracts by any other means. Contact the Program Committee Chair if your situation precludes use of the abstract submission website.

It is suggested and encouraged that a written summary of the Workshop or Symposium be submitted to Southeastern Biology for publication.

Non-Commercial Workshop/Symposium Proposal Submission Form

Title:

Submitters' Contact Information (address, phone, and e-mail address):

Session Description: In 400 words or less and in sentence form, describe the theme and purpose of this session.

Session Justification: In 250 words or less and in sentence form, provide the justification for this session.

One-sentence Summary: Summarize your proposal in 50 words or less.

Speakers and Titles: List all teachers/presenters (Workshops) or speakers and their titles (Symposia). Next to each participant, indicate if they are confirmed or only contacted and have not yet decided (unconfirmed). Do not list individuals who have not yet been contacted.

Funding: Explain how the Workshop or Symposium <u>as proposed</u> is to be funded. Symposium proposers may request needed funds from the ASB Executive Committee.

This form must be submitted to the following individuals no later than two weeks prior to the fall interim meeting of the ASB Executive Committee (deadline is September 1, 2014).

ASB President

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ASB

Paper and Poster Abstracts From the 75th Annual Meeting

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In Spartanburg, South Carolina

Meeting Site:

Spartanburg Marriott Convention Center

April 2-5, 2014

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Association of Southeastern Biologists 75th Annual Meeting April 2–5, 2014

Abstracts for Presentations

1 • Dennis D. Tarasi¹, Robert K. Peet²

Do Invasive Plant Species Impact Community-Level Species Richness or Composition Patterns in Temperate Forests?

Ecologists have pondered the impact of invasive species on biodiversity for several decades, with no clear consensus emerging. We analyzed forested vegetation plots from across the Carolinas at multiple scales to determine if plant communities with significant cover of exotic species exhibit differences in species richness or composition patterns as compared to plots of similar community types that have not yet experienced significant invasion. Our data reveal no significant change in mean species richness at any scale between invaded and un-invaded plots. Perhaps with more time or greater dominance by invasives a different pattern will be observed. However, species composition patterns noticeably differ between the two groups of plots. This result suggests that invasive species presence in ecological communities can affect community structure and organization, but in ways beyond what can be captured by simple species richness values.

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2 • S. Douglas Kaylor¹, M. Joseph Hughes², Jennifer A. Franklin¹

Recovery Trends and Predictions of High Elevation Forest Change in the Southern Appalachian Mountains

We asked if high-elevation forests in the Southern Appalachians are recovering from the widespread mortality of the 1980's and if there is evidence of forest composition shifts associated with hardwood encroachment. Great Smoky Mountains National Park supports some of the most extensive but threatened high-elevation forests in the southern Appalachians, which are dominated by the endemic Fraser fir (*Abies fraseri*). These forests are under considerable stress due to the balsam wooly adelgid (*Adelges piceae*), indirect and direct effects of pollution, and shifts in climate. Overstory and understory composition, mortality and recruitment were measured in thirty-seven 20x20m plots in 1990, 2000, and 2010 on 5 mountain peaks in the Great Smoky Mountains, representing almost the entire range of spruce-fir forests within the park. We created a stage-class population model to make predictions about future forests dynamics. Our population model predicts a mosaic of recovery across the landscape. Results show a decline in mortality rate over the study period, as well as an increase in forests with higher densities of canopy and sub-canopy fir. We also found no significant overall increase in the proportion of hardwoods, but with substantial variance among sites.

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3 • Jonathon K. Loyd1, Steven Murphree

A Comparative Study of Wildlife Diversity in an Old-Growth and Adjacent Secondary Growth Forest in Davidson County, Tennessee

Secondary growth forests typically have reduced biodiversity when compared to primary or old-growth forests. The Hill Forest State Natural Area is a 91.4 hectare old-growth forest in Davidson County buffered from residential areas by a secondary forest. Motion-detecting wildlife cameras provide a convenient way to determine the presence and relative abundance of wildlife in natural areas. Three wildlife cameras were placed in the old-growth forest and three in the adjacent secondary forest to monitor wildlife activity. Following previous studies, which have shown that old growth forests tend to have greater biodiversity than the secondary growth forests, we hypothesized that the old-growth forest would have greater wildlife diversity than the secondary growth forest. A preliminary analysis of photographs from each forest showed a higher diversity of wildlife in the adjacent secondary forest. A complete analysis including a contingency table produce a p-value less than 0.05, indicating a significant difference between the two forests and therefore rejecting the hypothesis

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4 · Gabrielle King, Wayne Rossiter

Assessment of the Roles of Endothermy and Ecothermy in Food Chain Length

It has been widely observed that aquatic ecosystems produce food chains that are longer than those of terrestrial systems. Several explanations exist for this pattern, including the difference in autotroph characteristics between the two types of environments, differences in carbon to nitrogen to phosphorous ratios of aquatic and terrestrial autotrophs and herbivores, and food chain length being governed by resource availability. However, the potential correlation between food chain length and the relative proportions of endothermic or ectothermic consumers remains unexplored. Endotherms have much higher sizespecific metabolic rates than ectotherms and are less efficient at transferring energy to its own biomass; they must consume more resources relative to body mass (or population biomass). Thus, a logical prediction is that food chains containing endothermic organisms might be shorter because they are less efficient in transferring energy up trophic levels. Anecdotally, we have observed that terrestrial communities contain many more endotherms as opposed to aquatic food webs. To examine the role that endothermy might have in limiting food chain length, we utilized the GlobalWeb database (Thompson et al. 2012), which contains nearly 400 food webs from terrestrial, freshwater and marine systems. This database was supplemented with several other high-resolution webs from the literature. We calculated the distribution and mean length of all food chains in each system, and considered species richness, taxonomic resolution, the relative proportions of endotherms and ectotherms, the frequency of omnivory and the relative number of endotherms on each trophic level as explanatory variables.

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5 · Katrina D. R. Moeller, H. Dawn Wilkins

Effect of Census Method and Season on the Number and Types of Vocalizations Uttered by Barred Owls in the Area Surrounding Reelfoot Lake, Tennessee

Barred Owls (*Strix varia*) are reportedly common in northwest Tennessee, however, a standardized census methodology has not been established. In addition, timing of breeding events are not well documented. Some Barred Owl vocalizations have been described and assigned possible functions. We hypothesize that owls may vary the frequency of call types depending on events in their life cycle. Our goals were to investigate the influence of census method and season on the detection of owls and study seasonal variation in the number and types of calls uttered. We conducted 5 and 10 min silent counts prior to playback of who-cooks-for-you-for-y'all calls followed by 5 and 10 min post-playback counts. Ten min silent counts were more effective at detecting Barred Owls

than 5 min silent, but 10 min post-playback counts were the most effective. A similar number of calls were detected during 10 min silent counts and 10 min post-playback counts. While playback did not increase the rate of vocalizing, we observed owls moving closer to the source of the stimulus making them easier to detect. We identified 11 types of calls in the field. Some calls were uttered at increased frequency post-playback suggesting possible territorial functions. To look for seasonal differences, we divided the year into 3-month intervals: nest prospecting, nesting, post-nesting, and dispersal seasons. We found no seasonal differences in the number of owls detected using 10 min silent counts. We heard significantly fewer calls during nest prospecting suggesting owls may be spending time less time on territorial defense.

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6 • Rachael Maulorico¹, John McCall²

Fish Communities in an Alabama Salt Marsh With Consideration of the Impact of the Deepwater Horizon Oil Spill Disaster

Intertidal salt marsh systems of the northern Gulf of Mexico are invaluable as nursery grounds, providing food and refuge for developmental stages of fish and invertebrates. The Deepwater Horizon disaster of April 2010 provided an opportunity to investigate salt marsh systems on Point aux Pins, on the Alabama coast. Data provided by NOAA indicated that the eastern side of the Point was lightly to moderately oiled in the Summer of 2010, while the western shoreline remained unaffected. Ecologically similar locations were identified on the impacted and un-impacted shorelines, and a sampling program was initiated to characterize the fish assemblage utilizing the two systems. Monthly collections were made with hand-held seines and other apparatus in similar microhabitats in tidal marsh creek systems on the eastern and western sides of Point aux Pins. Environmental data was collected in coordination with fish samples. Significantly more fish were collected from the un-impacted western tidal creek system. Both location and microhabitat were significant factors affecting abundance. Date was a highly significant factor affecting abundance, due to the seasonal utilization of the tidal creeks by early life history stages of dominant species. The un-impacted western tidal creek system also demonstrated slightly higher diversity. It is unclear if the observed differences are the result of oiling impacts or result from subtle environmental differences in the sampled microhabitats.

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7 • Tara L. Keyser¹, Peter M. Brown²

Climate-Growth Relationships for Yellow-Poplar Across a Structural and Site Quality Gradient in the Southern Appalachian Mountains

Individual tree growth is variable, driven by climate as well as by spatial patterns in forest types, stand structures, and site quality. Past dendrochronology studies linking tree growth with climate have failed to consider the interacting effects that site quality and stand structure have with variations in annual tree growth. This likely over-simplifies climategrowth relationships and the potential effect of climate change on both tree- and standlevel productivity. Quantitative information regarding the effects of climate on tree growth across a range of stand conditions is needed to inform management strategies that promote resilience (in terms of tree and stand-level productivity) under a changing climate. In 1961, 141 - 0.1 ha plots were established across a broad age and edaphoclimatic gradient in yellow-poplar stands throughout the southern Appalachians. Plots were thinned to varying levels of residual density, with detailed information on structure obtained every five years. In 2009, we collected increment cores from five yellow-poplar trees in 133 plots. Cores were processed using standard dendrochronological methods, and chronologies of annual basal area increment (BAI) were developed. We used BAI chronologies to quantify the relative importance of climate, stand structure, and site quality on annual growth. At the individual tree level, results suggest that reductions in stand density via thinning may ameliorate some of the deleterious effects climate can have on tree growth. These results may be used to develop management alternatives aimed at maintaining tree- and stand-level productivity and assess trade-offs among management scenarios under the context of a changing climate.

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8 • Lora Sigmon-Chatham¹, Alexander Krings¹, Zeb L. Robinson², Thomas Harris², Gary Blank², William Hoffmann¹

Historic Forest Structure and Composition of the Xeric Hardpan Forest Community of the Picture Creek Diabase Barrens; Insights From Dendrochronology

Picture Creek Diabase Barrens (Granville Co., NC), is a Nationally Significant natural area, hosting numerous plant species of conservation concern. This site is located in a Triassic basin and mafic soils underlie the majority of the property. The resultant mafic soils allow for unique plant communities, containing multiple threatened and endangered species. The forest structure at the site has been modified through farming, logging, and military management over the past century and there is evidence that a much more open canopy existed than at present. Using dendrochronological techniques we seek to gain a better understanding of the historic forest composition and structure of the Xeric Hardpan Forest community type at the site. We here report the results-to-date, based on analysis of tree cores sampled from square hectare plots. Our core data will be synthesized with historic satellite images, land use records, and data from subplots designed to determine recruitment in order to better understand what factors have affected the composition of this community type over the past century, and to inform future land management practices.

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9 • Rima D. Lucardi¹, Lisa E. Wallace², Gary N. Ervin²

Introduction History and Hybrdization Modulate Propagule Pressure in a Successful Exotic Grass Invasion: Cogongrass (*Imperata cylindrica*) in the Southeast

Successful biological invasions have been directly attributed to the strength of propagule pressure. The quantity of introduced genetic information is comprised of genetic material and the frequency of introduction. Therefore, introduction history and hybridization are components contributing to the quantity of introduced exotic material and may outline the potential of nascent populations. Secondary invasions (associated spatial spread) by exotics are subject to these same principles. Here, we analyze population-level genetic variation of the globally invasive plant species, cogongrass (Imperata cylindrica) in the southeastern region of the U.S. Genetic-geographic structure elucidated population-level genomic alterations during invasion within an invaded range; from site(s) of initial introduction to the front(s) of secondary invasion. A total of 676 individuals were collected from the field. Amplified fragment length polymorphic (AFLP) markers were utilized for molecular analyses. Genetic diversity estimates and population structure were assessed on the state-level. Differential genetic and clonal diversity values were observed among all states, with generally higher values in the states receiving purported initial introductions (Mississippi & Alabama). Population structuring was consistent with two separate introductions (K=2; $F_{ST} = 0.363$, P<0.001) of foreign material, further supported by reduced clonal diversity in secondarily invaded states. Genetic data is consistent with documented introductions of foreign material into Mississippi and Alabama. Cogongrass invasion in other affected states are likely the result of secondary invasions; states with high observed genetic diversity (i.e. South Carolina & Florida) probably resulted from propagule rain and differential management practices between states.

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10 • Luke H. Turner, Wade B. Worthen

Community Structure of Dragonfly Assemblages and Effects on Parasitism Rate: A Test of the "Dilution Effect"

Parasitism rates often decline with increasing diversity as the density of susceptible hosts is diluted' by non-susceptible species. We sampled dragonflies and their water mite parasites at seven ponds and lakes in northwest South Carolina and tested for this relationship. We also tested for developmental effects of parasitism by comparing the degree of bilateral asymmetry of ten wing characters between dragonflies with mites and those without mites, for three common dragonfly species. Sites were visited weekly, adult dragonflies were captured by aerial net and identified by species and sex, and the number of living mites was recorded. Dragonflies can starve mites by clogging mite mouthparts, so deflated (starved) mites were also counted. The left and right sides of Erythemis simplicicollis, Pachydiplax longipennis, and Libellula incesta individuals were photographed, and ten characters on the left and right wings were measured with ImageJ software and compared for symmetry. The rate of mite parasitism varied significantly between sites (7-23%) and among species (1-48%). Perithemis tenera and Argia fumipennis showed some resistance to parasitism; only 1.4% of P. tenera individuals had mites, and 80% of parasitized Argia fumipennis had deflated mites. There were no indications of a dilution effect; there were no significant negative correlations between parasitism rate and any measure of dragonfly community diversity. In addition, parasitism did not reduce bilateral symmetry. Curiously, parasitized L. incesta individuals were more symmetrical than those without mites. Subsequent experiments will examine the nature of the resistance seen in Argia fumipennis and Perithemis tenera.

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11 · Andrea L. Rodriguez, Victor R. Townsend, Jr.

Leg Morphology of Cosmetid Harvestmen (Arachnida, Opiliones, Laniatores)

Scanning electron microscopy (SEM) is useful for identifying informative taxonomic characters. Recent SEM studies have revealed a diverse assortment of sensory and glandular structures on the legs of gonyleptoidean harvestmen. With the taxonomy of cosmetid harvestmen in need of major revision, the examination of the microanatomy of the legs may provide useful systematic information. In this study, we used SEM to compare the microanatomical features of leg IV of 12 cosmetid species, including several members of the genera Cynorta, Erginulus, and Paecilaema. For comparative purposes, we also examined the legs of gonyleptoidean harvestmen representing the Agoristenidae, Cranaidae, Gonyleptidae, Manaosbiidae, and Stygnidae, We observed considerable interspecific variation with regards to the size, shape and number of tubercles of male leg IV (femur, patella, tibia and metatarsus). Among the species examined, Erginulus spp. were most similar to each other with respect to the morphology of leg IV. We also observed the presence of rough pit glands on the femur and patella of the legs of all 12 cosmetid species. With the exception of Erginulus spp. and Eupocilaema magnum, rough pit glands were also present on the tibia. We observed rough pit glands on the legs of only two gonyleptoidean species including Rhopalocranus albilineatus (femur, patella, and tibia) and Zygopachylus albomarginis (patella and tibia). Our results indicate that rough pit glands on leg IV may be a derived character for the Cosmetidae that has not been previously reported.

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12 . Zachary J. Loughman

Life History of the New River Crayfish in Anthony Creek, West Virginia

The life history of Cambarus chasmodactylus (New River Crayfish) was studied in Anthony Creek, West Virginia from May through October 2011. Animals were collected monthly from a stream reach with two complete riffle/run/pool sequences. Reproductive and molt states along with morphometrics were recorded for all individuals encountered,

after which, the majority of animals were returned to the stream. Monthly, 20-30 females were vouchered and dissected in the laboratory to determine monthly gonadal development. All ovigerous individuals encountered carrying eggs/instars were vouchered to determine egg/instar compliment values. Amongst adults two mass molts, one in May and another in September, occurred over the activity season. The majority of males molted from form I to form II in May and back to form I following the September molt. Females displayed active glair glands from May through late June, with oviposition occurring from July into early August. Females carried instars from September through the fall and possibly into winter. Ovigerous females had an average of 168 eggs/instars. Egg/instar complements was weakly correlate ($r^2 = 0.625$) to carapace length. Age histogram analysis indicated six size cohorts within the population, with the largest individuals possibly six years old or older. From these results, it was concluded that *C. chasmodactylus* displays K selected life history traits relative to other crayfish taxa.

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13 • Suellen F. Pometto, Peter H. Adler, Charles E. Beard

Reassembly of the Butterfly Proboscis, With Restored Functionality

Assembly of the lepidopteran proboscis by union of the two galeae has been thought to occur only at eclosion of the adult from the pupa. Our observations indicated that butterflies can reassemble separated proboscises, assisted by saliva production. The reassembly of the proboscis and the role of saliva were tested for the monarch butterfly, [Danaus plexippus] (Lepidoptera: Nymphalidae). The hypotheses were: (1) butterflies can reassemble a separated proboscis, (2) removal of saliva would impede reassembly, and (3) the reassembled proboscis can take up fluid. Seventeen reared butterflies were randomly assigned to three groups: (A) saliva collected into capillary tubes by manipulation of the proboscis for 5 minutes, (B) similar manipulation without removal of saliva, (C) no manipulation or removal of saliva. For each butterfly, the two galeae were separated through the distal two-thirds of the proboscis. Reassembly was evaluated by measuring: (1) time to achieve complete reunion of the galeae, and (2) diameter of the coil at 60 minutes after separation. All butterflies achieved 100% reunion of the galeae by 30 minutes. Both manipulated groups were similarly impeded, whether or not saliva was removed. To test restoration of functionality, butterflies were fed dyed sucrose water and placed in separate cages lined with filter paper. If no dye-colored gut exudate was produced on the filter paper after 24 hours, the butterfly was dissected. The presence of dye in the exudate or gut was found in 16 of 17 specimens, confirming successful feeding.

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14 • Marc A. Milne¹, Marcelo Schwarz²

Size Matters: Purple Pitcher Plant (Sarracenia purpurea) Pitcher Size Influences the Presence or Absence of Aedes albopictus Larvae

A vector of multiple arboviruses, the invasive Asian tiger mosquito, *Aedes albopictus*, was recently found to develop inside the pitchers of the purple pitcher plant, *Sarracenia purpurea*, in a forested environment. In this study, larvae and pupae of *Ae. albopictus* were found in *S. purpurea* pitchers in a peridomestic habitat in central North Carolina. Evidence of direct oviposition on the inner sides of the pitchers was obtained by dissecting pitchers and examining the insides for eggs, which were then raised to adults. To determine if immature *Ae. albopictus* were present in pitchers of a certain size and distance from other mosquito-occupied pitchers, pitcher size and relative distance were measured and compared against the presence/absence of larvae and/or pupae through a logistic regression analysis. Very strong statistical evidence showed that larger pitcher openings (>~2 cm diameter) were much more likely to contain larvae and/or pupae and that closer pitchers were not significantly more colonized than more distant pitchers. These data, in combination with the presence of dead adult females in pitchers, suggest

that the smaller diameter of some pitchers may prevent successful oviposition by gravid females.

255

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15 • Amy M. Gutting¹, Jennifer A. Zettler¹, Lawrence W. Zettler², Larry W. Richardson³

Mealybugs: An Old Threat Poses a New Risk to Native Epiphytic Orchids in South Florida

About one fourth of orchids in North America are found within three counties in south Florida, all in or near the Florida Panther National Wildlife Refuge (FPNWR). During a survey in 2010, scales were found infesting native epiphytic orchids there. On a return visit in 2012, a novel discovery was made--the presence of the orchid mealybug *Pseudococcus microcirculus* in the nearby Fakahatchee Swamp. In California, this mealybug has been known to be a problematic pest of orchids in greenhouses. Until now, no published records have documented *P. microcirculus* on orchids in natural habitats, much less those in Florida. In 2013, the FPNWR was surveyed to identify the extent of the infestation. *P. microcirculus* was found on five endangered epiphytic orchid taxa, including the Florida clamshell orchid, *Prosthechea cochleata* var. *triandra*—which is endemic to south Florida. In addition, 3.3% (4 of 118 plants) of these infested clamshell orchids harbored yet another common greenhouse pest, Boisduval scale, *Diaspis boisduvalii*. In cultivation, feeding damage by scales and mealybugs weakens plants and can even cause death. It is unknown how the presence of these insects in the FPNWR will affect the long-term health of Florida's endemic orchid populations.

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16 • Brian Scholtens¹, Joe Culin², John Snyder³, Tom P. Smith⁴

The Moths of Congaree National Park

From October 2009 to September 2010, we sampled moths in Congaree NP one weekend per month. Each month we placed traps, ran a light sheet, and, during the winter months used bait to attract moths. We recorded individual data on about 11,000 moths including over 1000 species. For the Macrolepidoptera groups (those with the best sampling coverage), we averaged about 240 species per month from April through September, with slight peaks in species diversity in June and September. Microlepidoptera show the same trend, but our summer sampling of these groups was less intensive. Our species totals are comparable to those from the Dominick collection at the Wedge Plantation. We recorded 173 state records.

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17 • Peter A. Van Zandt¹, Benjamin Hunt¹, Sarah Martin², Grant Gentry³

Are Warm Bugs Early Bugs? The Impact of Birmingham's Urban Heat Island on Moth Phenology

Several studies have used historical data to explore whether increasing temperatures over time correlate with advanced phenologies in a number of species, ranging from plants to insects. In our study, we substituted space for time to determine if urban heat islands (UHIs) produce a temperature change large enough to advance moth phenology relative to rural areas. UHIs occur in densly populated areas where significant amounts of vegetation have been replaced with urban building materials. The combined loss of evapotranspiration and addition of heat-retaining materials yield air temperatures 1-3 C warmer than surrounding rural air temperatures. We evaluated our prediction by studying 11 focal species found at three sites along an urban to rural gradient centered aroudn Birmingham, Alabama. Of the four focal species abundant enough to analyze, three appeared to emerge earlier at the urban site; however, differences were statistically significant for only one of three species. While higher urban temperatures appear to affect

moth phenology, responses to this anthropogenic local climate change tended to vary among species. It is important to study the mechanisms and directions of phenological changes because many species rely on synchronous interactions with host plants and natural enemies. Therefore, differential responses of species may lead to phenological mismatches that impact species interactions. Studies like this that use space-for-time substitution may serve as models for larger scale, temporal climate change.

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18 • Tom J. Fink, Alina Suedbeck

How Lepidopteran Larval Spiracles are Really Made: The Lamellae

The external lamellae of larval spiracles are often easily noticed by eye or a stereo microscope. Despite their importance, the larval spiracle lamellar structure has been inadequately studied and described, Lamellae largely are considered to be fingerlike projections and in most cases lamellae are imaged with one or two surface Scanning Electron (SEM) micrographs. Larval lamellae in different species range from simple lamellae that can be described from two-dimensional micrographs, to in most cases lamellar carpets that must be imaged from three-dimensional analyphs or stereo pairs in order to correctly ascertain their structure and the differences between species. We find it necessary to image most larval spiracles with many stereo pairs taken from different angles of view. It is also necessary to make transverse cuts of the spiracles to see the true three-dimensional structure of the lamellae and to view the interior of the spiracles. In large species we also dissect the specimen so as to view the entire spiracle from the interior. Lamellar plates linked together to form lamellar carpets show an economy of structure so that air filtration tubercles, projections, or filaments are arranged only on the dorsum and laterally on the carpet that faces the other side. We will present images from over a dozen species, many through stereo anaglyphs, and some species will include first as well as mature and final instars. Many images are from live larvae imaged directly in a variable pressure SEM.

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19 • David M. Donnell

Caste-Bias in Odorant-Binding Protein Genes of the Polyembryonic Wasp *Copidosoma floridanum*

A single egg from the polyembryonic wasp *Copidosoma floridanum* produces soldier and reproductive larvae during development within its caterpillar host. The expression patterns of 8 *Copidosoma* odorant-binding protein (OBP) genes were investigated for caste-bias using both reverse transcription-polymerase chain reaction (RT-PCR) and in situ expression studies. Six of the 8 genes are clearly biased in their expression towards one or the other larval caste. Three distinct in situ probe hybridization patterns were observed for the OBP genes, none in tissues with a known chemosensory function. Two of the expression patterns suggest the majority of the OBP genes come into contact with hemolymph of the host caterpillar. One of these expression patterns was uniquely associated with the extra-embryonic membrane encompassing each of the reproductive larvae. The absence of OBP gene expression in the membrane surrounding soldier larvae suggests many of the genes characterized in this study are performing caste-specific functions in the host.

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20 • Stephanie R. Balser, Jennifer A. Zettler, Bil Leidersdorf

Preference of Insect Frass in Fungus Gardening Cyphomyrmex Ants

The *Cyphomyrmex* genus of fungus-growing ants is a little known group related to the better-known leafcutter ants of the genus *Atta*. Unlike the leafcutters, *Cyphomyrmex* ants use herbivorous insect excrement, or frass, rather than leaves, as a substrate for their fungal gardens. Given the transient nature of herbivorous insects such as caterpillars (Order Lepidoptera), we wanted to determine whether *Cyphomyrmex* ants are generalists

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or exhibit a preference for substrate used for the growth of fungi. In preliminary tests, colonies of *Cyphomyrmex rimosus* from Chatham County GA were collected and housed in artificial nest chambers consisting of a series of Petri dishes connected by tubing. Ant colonies were allowed free access to test arenas with frass from six different families of Lepidoptera that were reared on five different types of host plants. We assessed ant preference by quantifying the respective amounts of frass removed from arenas. We found that *Cyphomyrmex* showed a preference for frass based on its size and host plant upon which caterpillars fed.

Dept of Biology, Armstrong Atlantic State University, Savannah, GA

21 • Justin C. Strickland¹, Ana P. Pinheiro¹, Kristen K. Cecala², Micahel E. Dorcas¹

Physiological Constraints to Respond to Climate Change: Insights From the Effects of Temperature on Standard Metabolic Rate in Larval Salamanders

Predictions of climate change susceptibility are critical in forming conservation policy, however, these predictions cannot be generalized even among sister taxa. As such, the development of species-specific, quantitative predictors of sensitivity to thermal increases is vital to the proper allocation of conservation resources and priorities. Climatic variability hypotheses propose that species occupying larger geographic ranges should develop more robust physiological tolerances and be more resistant to temperature changes. In this study, we investigated the effects of temperature variation on standard metabolic rates (SMR) of two species of larval salamanders, Eurycea cirrigera and Eurycea wilderae, that share similar life histories but occupy distinct range sizes. Specifically, SMR was determined using volume of oxygen consumption during closed-circuit respirometery trials conducted at 5 °C increments between 5 and 25 °C. Standard metabolic rates were influenced by temperature, with a range of temperature-independent SMRs observed at those temperatures above each species' laboratory-determined thermal preference. Concordant with their thermal preference (15.70 °C) and more narrow geographic range, E. wilderae exhibited a smaller scope of temperatures at which SMR was temperaturedependent relative to E. cirrigera and showed depressed metabolic rates at the highest temperature tested. Our results provide a mechanistic link for an ecological predictor of climate change susceptibility (i.e., range size) and indicate that physiological specialization that occurs in species of narrow geographic ranges may preclude adaptations to climate change.

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22 • John J. Hains, Jessica Logan, Brittany Broome, Sarah Fishburne, Lauren Frees, Rebecca Helstern, Joshua Howard, Garrett Woollen

The Ecology of a New Invasion by Bellamya japonica In the Savannah River Basin

The first known infestation of Bellamya japonica in the Savannah River Basin was discovered in 2006 near Clemson, SC. Investigations of this population led to the subsequent discovery of an industrial impact and several questions regarding their distribution and behavior. Teams of undergraduate research students have completed experiments on phototaxis and geotaxis and concluded that there exists a significant negative phototactic response but no detectable geotactic response. In addition, a study of dispersal using mark-recapture methods concluded that while this technique was useful to follow the life history of individual snails, they did not meet the assumptions of the markrecapture technique and therefore this method could not produce a reliable population estimate. Studies of fecundity have shown a seasonal trend with an unsurprising correlation to water temperature and time-of-year. Fecundity rates are still being assessed for size-dependent relationships. Age Is difficult to determine and the life history studies using marked specimens will assist with this as well. While fecundity is one important factor for population growth, individual metabolism is also important and unknown for this species and studies of the metabolism of this species are described in a separate presentation. Early anecdotal observations suggested a possible circadian rhythm with regard to fecundity as well. A systematic study of this possible phenomenon is also in progress. If successful we hope that our studies will provide a better understanding of the basic biology of this organism which will help with management in the future.

Dept of Biological Sciences, Clemson University, Clemson, SC

23 • Sarah Fishburne, Jessica Logan, Brittany Broome, Lauren Frees, Rebecca Helstern, Joshua Howard, Garrett Woollen, John Hains

Metabolism of Bellamya japonica: Experimental Design and Limitations

The metabolism of the Japanese Mystery Snail Bellamya japonica has not been reported previously, in spite of its ecological importance as an invasive species in North America. Little is known about this species as an invasive and while our research includes ecological investigations of distribution, behavior, and fecundity, we also are beginning basic biological studies related to growth and metabolism. At this time we have begun studies of respiration using measurements of oxygen consumption and are refining our methods. In order to remove any error in the measurement of oxygen consumption by external bacteria, the specimen must be cleaned. Bacterial culture trials using a variety of disinfectants indicated that physical scrubbing without any disinfecting agent was sufficient to prevent error. The metabolism of cleaned specimens will employ a sealed, respiration chamber, filled with filtered lake water. The oxygen consumption will then be measured over an empirically derived time. The fate of oxygen consumption will then be used to determine the specimen's respiratory rate and this will be repeated to determine the effect, if any of habitat conditions such as temperature. Locally-collected specimens from the wild' are employed with sufficient replications to meet normal' statistical assumptions. In addition, specimens are subdivided into gender classes as well as controlled for biomass. Controlled metabolic estimates are made for varying thermal and pO2 conditions to determine the niche limits of this invasive species. Preliminary results for this study are presented here as well as plans for proposed extensions of this research.

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24 • Amy R. Wethington

Distributional Differences in the Freshwater Pulmonate Snails *Physa acuta* And *Physa qyrina*: Competitive Exclusion or Habitat Choice?

Experiments were designed to test the effects of water quality and biological interaction on two congeneric species of freshwater pulmonate snails, *Physa acuta* and *Physa gyrina*, in order to understand their distributional patterns in the Griffy lake reservoir and surrounding wetland areas. It was my intent to discover what ecological factors restrict P. acuta to the reservoir and P. gyrina to the adjacent wetland area (Griffy Pond). I conducted three biological interaction treatments (two intraspecific and one interspecific) and two different water treatments (lake water and pond water), each treatment containing ten cultures of four snails. These results suggest that P. acuta negatively impacts P. gyrina's growth and egg laying while P. gyrina is left to take advantage of the more rich pond environment perhaps due to P. gyrina's high tolerance to heat and dessication. These two species are rarely found in the same water body and when they are, they tend to occupy different ecological space.

Chowan University

25 • Daniel Hoffman, Troy Mutchler, William Ensign

Quantifying Potential Differences in Trophic Relationships Across Freshwater Streams of Varying Urbanization

Interactions between terrestrial and aquatic ecosystems play an important role in ecosystem structure and function. For instance, urbanization near watersheds and riparian zones modifies not only the physical landscape, but also alters the linkages to nearby stream habitats through hydrology, sediment transport, and nutrient cycling. Modification to nutrient cycling through the addition or reduction of allocthonous material from surrounding terrestrial ecosystems may alter the nutrient and organic matter composition

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of the local aquatic system and affect the relative abundance of organisms at different trophic levels. To examine the potential differences in stream food web composition between urbanized and rural environments we selected three streams of similar size from two counties in the metropolitan Atlanta, GA area. Representatives of each trophic level (including periphyton from various substrata, plant material, invertebrates, and fish) were collected from each study site, dried, pulverized, and analyzed for ¹³C and ¹⁵N content. Feeding relationships will be identified based on these stable isotope signatures and comparisons will be made to detect changes in various trophic levels between the streams. Additionally, nutrient content of the tissues will be used to assess the differences in nutritional value of food sources across streams.

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26 · Joseph M. Dirnberger, Julia Love

Seasonal Shifts to Planktonic Prey by the Eastern Mosquitofish, Gambusia holbrooki

Fish and macroinvertebrates in wetlands are known to consume micro-crustaceans and rotifers, potentially impacting zooplankton assemblages within macrophyte beds and in adjacent open water. However, determining whether invertebrate taxa within vegetated areas are planktonic is difficult because most sampling devices are likely to capture both truly planktonic organisms as well as those closely associated with macrophyte surfaces. This study examines seasonal changes in type of prey consumed by the Eastern Mosquitofish Gambusia holbrooki in a small beaver-created wetland (Cobb Co., Georgia), and assesses the degree to which prey taxa vary in planktonic behavior by using traps that passively sample plankton moving through the water column. Aquatic insects were dominant in mosquitofish guts in the autumn 2012. Diet shifted to the small cladoceran Chydorus sp. in spring 2013, then to a mix of larger cladoceran taxa and terrestrial insects in the summer, and to another small cladoceran Bosmina longirostris in the second fall. During the winter of both years, fewer prey were taken and no single taxon dominated. Both species of small cladocerans showed planktonic tendencies and shifts to these small cladocerans tended to reflect seasonal changes in abundance. Mosquitofish electivity estimates were positive for both taxa, though were quite negative for other planktonic taxa (copepods and ostracods). Benthic prey availability did not change dramatically over seasons, and mosquitofish diet breadth did not decline during periods of high cladoceran consumption. Results indicate that Gambusia holbrooki actively and differentially take taxa that are planktonic, demonstrating the potential of G. holbrooki to alter plankton assemblages.

Dept of Biology and Physics, Kennesaw State University, Kennesaw, GA

27 • Vanessa Y. Rubio, Kirsten A. Work

The Effects of Nutrient Cycling by the Exotic Catfish, Pterygoplichthys Disjunctivus, on Algal Growth in a Central Florida Spring

Nutrient recycling by fish plays a large role in the availability of nutrients, such as nitrogen and phosphorus, in freshwater aquatic systems. The invasive exotic catfish, *Pterygoplichthys disjunctivus*, has infiltrated central Florida springs and may have contributed to algal overgrowth in these springs due to its digestive by-products. In this research, we focused on whether algae would grow on microscope slides as a direct result of the presence of *P. disjunctivus* feces in situ by implanting an array in Volusia Blue Spring to measure algal growth. The algal accumulation in control and experimental treatments was compared using dry mass as well as spectrometry for chlorophyll *a.* Algae also were grown over the course of four weeks in a growth medium to measure growth rates of viable algal cells in the feces. There was significantly more growth of algae in the presence of *P. disjunctivus* feces than in controls. In addition to promoting algal growth, *P. disjunctivus* feces were found to contain viable algal cells that were thriving after being excreted. The addition of nutrients and viable cells due to the presence of feces could be a contributing factor to eutrophication and ecological shifts in Volusia Blue Spring. Biology Dept, Stetson University, DeLand, FL

28 • Tommy B. Blanchard¹, Jeffrey Fore²

Preliminary Assessment of the Ecological Effects of Natural Channel Design Stream Restoration Projects in West Tennessee

Natural channel design (NCD) principles are increasingly used in stream restoration projects that aim to remediate degraded stream channels. NCD projects have been constructed in West Tennessee to reverse stream channelization, reestablish channels through valley-plugged systems, and reduce localized flooding. The ecological effects of these projects are poorly understood and our goal was to assess how fish assemblage composition differed between restored and channelized streams as related to physical habitats. A control/impact sampling design (three streams, two treatments, and three replicates per treatment) was used to inventory instream physical habitat and collect fish assemblage data at eighteen sites. Fish samples were summarized as the relative abundance of each reproductive guild (number of individuals in guild/total number of individuals in sample). Canonical correspondence analysis was used to determine how reproductive guild composition was affected by physical habitat variables at channelized and restored sites. Ass emblage composition in restored streams was positively associated with mean water depth and negatively associated with number of observed channel units; these streams had higher occurrences of guarding behaviors, substrate generalists, and vegetation spawners. Assemblage composition varied among channelized streams with one having a similar composition to restored streams, another being dominated by species with high parental investment and low channel complexity with few flowing water habitats, and the third having a high abundance of non-guarding lithophils associated with flowing water habitats and number of channel units. Hair restoration projects generally affected fish assemblage composition (with one exception) and the specific effects appeared to be system dependent.

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29 • Nicole M. Sadecky, Luke K. Sadecky, Zachary J. Loughman

Development of a Captive Rearing Protocol for Cambarus Crayfish: A Pilot Study With New River Crayfish

Though considered one of the most imperiled animal groups in the country, North American crayfish have received little active conservation outside of regional inventories and isolated life history studies. Captive rearing of endangered crayfish is a potential avenue of recovery, especially for species occurring in regions where stream degradation is actively occurring, if stream recovery is possible post disturbance. To see if it is conceivable to rear Cambarus species from egg to adult, a pilot study was initiated with New River Crayfish (Cambarus chasmodactylus) as surrogates for endangered species. Ten ovigerous female C. chasmodactylus were captured in Anthony Creek, West Virginia and relocated to 40 gallon rearing tanks, with two females placed in each tank. Two treatment groups, natural and artificial were tested to determine if natural conditions were needed for successful rearing of neonates. Natural tanks included small slab boulders as hides; artificial tanks maintained 30 cm terra cotta disks as hides. All female's eggs hatched, and underwent development to stage four instars, without a difference in size, survival, or time to stage four between treatment groups. Instars were segregated into two additional treatments following stage four development. With mother neonates were allowed to stay with their mothers, and without mother neonates were separated from their mothers. Growth and survival between groups was similar, though the largest neonates were associated with the with mother group. Future efforts will focus on determining age to sexual maturity in captivity.

Dept of Natural Science and Mathematics', West Liberty University, West Liberty, West Virginia; ² Dept of Natural Science and Mathematics', West Liberty University, West Liberty University, West Liberty University, West Liberty, West Liberty, West Liberty, West Virginia

30 • Michael J. Lucero, Raquel A. Fagundo, Nicole M. Sadecky, Zachary J. Loughman

Determination of Causal Mechanisms in Cambarus Crayfish Assemblage Structure in Central Virginia

Crayfishes are receiving more research attention currently than ever before. A focus of this research is determining how similar crayfish species delegate resources amongst members of a localized crayfish assemblage. To answer this question, members of the cravfish Genus Cambarus were sampled across the Upper and Middle James and Roanoke basins in Virginia over the 2012/2013 summers season. Ohio EPA Quality Habitat Evaluation Sheets were filled out at each site, with each subscore used to represent habitat specifics (substrate, channel width, overall habitat quality etc.). Scores were matched with species presence/absence data for each taxa occurring in the selected watersheds, then modeled for each species using logistic regression, to determine which habitat variables correlated with each taxa presence at a site. Cambarus sp. C, Cambarus bartonii and Cambarus longulus were the crayfishes that made up the regions Cambarus assemblage. Logistic regression results from sampling one hundred twelve sites indicated that each Cambarus species presence was dependent on different QHEI metrics. Cambarus bartonii presence was correlated to stream gradient (AAICc= 0.00), Cambarus sp. C. presence was correlated to pool quality (AAICc= 0.00), and C. longulus presence was correlated to substrate type (ΔAIC= 0.00). In addition to specific habitat parameters. different cambarid taxa dominated different stream orders, and riffle, run and pool habitats across all watersheds studied. Results from this studied provided evidence for specific habitats parameters that are important drivers in crayfish assemblage construction and maintenance.

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31 • Cathryn H. Greenberg¹, Beverly Collins², W. Henry McNab¹, Douglas Miller³

Introduction: Natural Disturbances Shaping the Structure and Composition of Central Hardwood Forests

Natural resource professionals often seek reference conditions, based on the historic range of variation in natural disturbances, for defining forest management and restoration objectives. In upland hardwood forests of the Central Hardwoods Region, wind, fire, ice, drought, insect pests, oak decline, floods, and landslides are recurring or episodic natural disturbances that can kill or damage scattered- to small or large groups of trees across small to large areas. The spatial extent, frequencies, and severities differ among these natural disturbance types and create mosaics and gradients of structural conditions and canopy openness within stands and over the landscape. A new (2012) forest planning rule requires that national forests be managed to sustain ecological integrity and within the historic range of variation of natural disturbances and vegetation structure. This highlights the need to use best available science to describe the historic types, frequencies, and severities of natural disturbances, and the scales and gradients of forest structural conditions they created. This symposium brings together experts to address how a wide variety of natural disturbance types historically created heterogeneous structure within central hardwood forests. Here, we introduce the region and historical range of natural disturbance to provide a foundation for the symposium and further discussion of whether, and how, historic disturbance regimes should solely guide forest management on national forests and other public lands.

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32 • Justin L. Hart

Gap-Scale Disturbances in Eastern Oak Forests With Implications for Management

All forest ecosystems are subject to endogenous and exogenous disturbance events which influence species composition and stand structure and drive patterns of stand development. Disturbances may be categorized by a variety of characteristics, but they are most often classified along a continuum according to their spatial extent and magnitude. This continuum spans from broad-scale, stand-replacing events where most of the overstory is removed to fine-scale events resulting from the removal of a single canopy individual or a small cluster of trees. Although all forests may be exposed to stochastic, exogenous disturbances, the disturbance regimes of most oak stands in the Eastern Deciduous Forest are characterized by fine-scale, endogenous events. At the stand scale, these localized and asynchronous disturbances may create a patch-work mosaic of microsites comprised of different tree species, ages, diameters, heights, crown spreads, and growth rates. Through the modification of fine-scale biophysical conditions. these localized canopy disturbances promote heterogeneity and biodiversity in oak forest ecosystems. The gap formation rate in oak stands is typically 1-2% year-1. However, some studies have indicated that gap-scale disturbances were historically more common and a reduction in gap events may in part explain the regeneration failure of oak across the eastern USA. Management based on natural disturbance processes should consider elements of the gap-scale disturbance regime such as frequency, size, shape, and closure mechanisms and the historical range of variation associated with these characteristics. Silvicultural prescriptions are available for gap-based management designed to promote oak regeneration and mimic natural disturbance processes.

Dept of Geography; University of Alabama, Tuscaloosa, Alabama

33 • Steven Oak1, Martin A. Spetich2

Oak Decline in Central Hardwood Forests: Frequency, Spatial Extent, and Changes to Forest Composition and Structure

Pathogens and insects regulate forest composition and structure by causing growth loss and mortality in host trees. One such change agent distributed widely in the central hardwood region is oak decline. Episodes have been reported since the early 1900's throughout the region. Oak decline is a stress-mediated disease resulting from the interactions of physiologically mature trees; abiotic and biotic stressors that alter carbohydrate physiology; and opportunistic root disease fungi and insects. Symptoms include reduced radial growth and slow, progressive crown dieback from the top downward and outside inward in upper canopy trees occurring over years to decades. often ending in death. Species in section Leucobalanus are less susceptible to oak decline mortality than species in section Erythrobalanus. Patterns of oak decline on the landscape vary widely. Mortality patches can range from a few trees in stands with relatively diverse species composition and age structure, to several thousand hectares in landscapes with a more uniform composition of physiologically mature Erythrobalanus species subjected to drought in combination with repeated defoliation by the non-indigenous gypsy moth. Past disturbances shaping current species composition and age structure are inextricably linked to oak decline vulnerability. Noteworthy examples are the functional extirpation of the American chestnut by the non-indigenous chestnut blight pathogen and changing disturbance patterns including fire suppression and reduced harvesting, all occurring during the early 20th century. Data from regional long-term monitoring surveys were used to develop models predicting the probability and severity of oak decline events as part of the Forest Vegetation Simulator (FVS).

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34 • John Nowak, William Carothers, Kier Klepzig

Southern Pine Beetles: Frequency, Spatial Extent, and Changes to Forest Structure Across the Southeastern Upland Hardwood Forest Region

The southern pine beetle is a major disturbance factor in pine forests throughout the range of southern yellow pines, mostly impacting Coastal Plain and Piedmont forests of the Southeast. However, this insect also has significant influence on forests throughout the southeastern upland hardwood forest region because it has been known to attack and kill Eastern white pine, table mountain pine, pitch pine, shortleaf pine and red spruce. This disturbance does impact Southern Appalachian forests by converting stands to other species types, changing the age and stand structure. Southern pine beetle can create disturbance in stands in large clusters of pine trees or by hastening the succession from pine-hardwood forests to the climax forest. Southern pine beetle populations are cyclical and have traditionally impacted upland hardwood forests about every 20-25 years. The last outbreak in this ecoregion occurred from 1997-2002, impacting more than 1 million acres and causing an estimated economic loss of \$1 billion across 5 states. In this chapter we will examine the spatial extent, frequency and severity of disturbance that this insect has caused to forests in this region over the past 50 years and how this disturbance has altered the resultant forests. Additionally, although this insect has been known to be a factor in upland hardwood forests since it was first intensively studied in the early 1900's, we will discuss the possibility that this disturbance has become more frequent and more intense due to changes in climate in this ecoregion.

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35 • Chris J. Peterson¹, Christopher M. Godfrey²

Meteorological and Ecological Perspectives on the Patterns and Consequences of Wind Disturbance to Central Hardwood Forests

Wind disturbance is one of the most pervasive types of natural disturbance, perhaps second only to fire in the variety of forests impacted, and in the resulting changes for forest structure, composition and functioning. Here we attempt to synthesize available information on the size, frequency, seasonality, and broad-scale spatial patterns of several of the major types of wind disturbance - thunderstorms, derechos, tornadoes, hurricanes, and the recently-recognized mountain wave winds. Each of these types of storms has particular meteorological causes and dynamics, which we will describe in light of potential to impact forests. Each also has characteristic geographic and topographic trends, such that particular geographic and topographic locations are more or less likely to experience wind disturbance. The sizes of, and wind velocities within, the meteorological phenomena directly translate into spatial patterns, extent, and severity of impacts to forest, which again differ among the types of storms. We further summarize what is known about how such disturbances alter the structure, composition and functioning of southeastern hardwood forests. At the community level we explore how wind disturbances change species composition, relative abundances and dominance among species, as well as richness and diversity. At the ecosystem level we summarize known and hypothesized effects on trace gas fluxes, nutrient cycling, and carbon dynamics. In so doing, we will highlight existing gaps in our knowledge, and suggest fruitful areas for near-future research to answer important questions. Finally, we consider lessons of these wind events for management that seeks to emulate natural disturbances.

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36 • Henri Grissino-Mayer1, Charles Lafon2

Fire Regimes of the Southern Appalachian Central Hardwood Forests: Effects of Climatic and Human Influences

Forests of the central hardwood region include pine, oak, and other communities that benefit from fire. Some plant species (such as Table Mountain pine) exhibit adaptations to

the effects of repeated wildfires over millennia. Direct and indirect evidence of these past fires can be found in many habitat types, especially those where yellow pines constitute part of the forest type. This evidence is in two forms. First, fire scars form when a fire damages the trunk of yellow pines and hardwoods; these can be dated to an exact year in the tree-ring record. Second, forests can change in species composition, age structure, and forest structure with changes in fire activity, whether caused by natural processes or by humans. In the southern Appalachian Mountains, we created a network of fire history sites that reveals fire to have been common from at least the 1600s/1700s until the fire-exclusion era, contradicting the perception that fire was an uncommon ecosystem process in the humid Appalachian region. Fire was not strongly related to drought conditions at most sites, possibly because of overriding influences of human ignitions in our data. However, spatial patterns of fire were consistent with greater fire activity in places with a more favorable fire climate. Current fire activity across the central hardwoods region varies spatially with climate; if pronounced spatial patterns existed across the region in the past, these patterns may account for some vegetation patterns we observe today.

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37 • Charles Lafon

Ice Storms in Central Hardwood Forests: The Disturbance Regime and Vegetation Influences

Freezing rain occurs more commonly in eastern North America than elsewhere on earth. During a major freezing rain event, or ice storm, heavy ice loads accrete onto trees, stripping branches, snapping boles, and uprooting trees. Freezing rain commonly develops throughout a large area within a winter storm, and therefore a single storm can damage broad swaths of forest. These disturbances greatly exceed background gap formation in severity and extent, but they do not generate the catastrophic mortality associated with severe fires or windstorms. Ice storms create disturbances of intermediate severity. A paucity of appropriate weather data obscures freezing rain climatology, but some generalizations are possible. Ice storms occur most frequently in the northeastern and Midwestern U.S., and a zone of high frequency also extends southward along the Appalachian Mountains and Piedmont. In mountainous landscapes, disturbance severity varies strongly over elevational and topographic gradients. Ice storms appear to be a primary disturbance agent on slopes with greatest exposure to these periodic events. A number of studies have investigated ice storm damage at the scale of forest stands. Tree species vary in susceptibility, with pioneer species typically sustaining heaviest damage and mortality. Less is known about longer-term consequences for age structure and species composition. The large gaps appear to provide recruitment opportunities for lightdemanding colonizers. At the same time, the damage-resistance of slow-growing, stresstolerant trees such as hemlocks and oaks likely enable persistence in ice-prone forests. The ecological role of ice storms depends, in part, on interactions with fires and other disturbances.

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38 • Titian Ghandforoush, Kathleen A. Kron

Phylogenetic Reconstruction of Relationships in the Paleotropical Vaccinieae (Ericaceae) Based on DNA Sequence Data

The Vaccinieae (Ericaceae), or the blueberry tribe, is a clade with an intercontinental distribution, excepting Antarctica. The tribe is an extremely diverse group in both vegetative and floral morphology and contains in excess of 1000 described species. Most of the species occur in the tropics where they are a major component of montane cloud forests. Previous large-scale phylogenetic analyses of Vaccinieae included few representatives of paleotropical taxa compared to the more extensively sampled neotropical and temperate species. Results of those studies indicated that both the neotropical and paleotropical taxa are likely to be paraphyletic, with divergent clades often

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closely related to temperate species. This suggests that the diversity of taxa in the Vaccinieae seen in the tropics may be due to the independent diversification of several clades rather than a result of a single tropical origin. However, many of these relationships lacked strong statistical support. In this study we analyzed evolutionary relationships of the Vaccinieae with particular emphasis on paleotropical species. Representative sampling of the paleotropical Vaccinieae has been significantly increased and combined with the DNA sequence data available from previous analyses. Maximum-likelihood and Bayesian analyses were used to reconstruct the phylogeny. The results indicate that clades of both neotropical and paleotropical Vaccinieae likely evolved multiple times, with some paleotropical clades showing distinctive biogeographical relationships.

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39 • Andy G. Gardner¹, Kelly A. Shepherd², Dianella G. Howarth³, Rachel S. Jabaily¹

The Australian Plant Family Goodeniaceae as a New Model System for Floral Symmetry Evolution

The members of Goodeniaceae are mostly restricted to Australia, where it is the ninthlargest family of flowering plants with more than 420 species. The major clade, Core Goodeniaceae, exhibits a kaleidoscopic array of floral morphologies, with species that have radial, bilateral and fan-shaped flowers. Recent phylogenetic evidence suggests that these floral morphologies have evolved multiple times, with differential lability in floral form between major clades. Some clades contain multiple morphologies, and several clades appear to have evolved convergent floral morphologies. To better characterize this dramatic radiation of Australian wildflowers, we are improving the backbone and sampling of our phylogenetic trees, characterizing floral morphologies using morphometrics, and assessing the role of CYCLOIDEA-like genes in petal development, For the phylogeny, we are building character-rich datasets using Illumina genomic libraries and species-rich datasets with Sanger sequence data. Two-dimensional geometric morphometrics allow us to assess floral shape variation within and among species, to assign species to discrete bins for comparative studies, and to detect evidence of modularity in floral morphogenesis. Evidence for modularity also comes from CYCLOIDEA expression patterns, which may have been elaborated by gene duplications early in some of the clades' histories. This project will yield a nearly-comprehensive phylogeny for the Core Goodeniaceae along with a detailed picture of floral morphological evolution across the clade. It will lead to a better understanding of the mechanisms of floral evolution and its role in the diversification process.

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40 • Joshua L. Steele, Richard Carter

Floristic Inventory of the Lake Louise Field Station, Lowndes County, Georgia

An inventory of the vascular plants and plant communities of the Lake Louise Field Station (LLFS) in Lowndes County, Georgia was conducted. Centered on a karst pond encompassed by an extensive bayswamp community, the LLFS is a 76.9 hectare area owned by Valdosta State University. The adjacent uplands include remnants of liveoak hammock and longleaf pine-wiregrass communities, as well as mesic flatwoods and an abandoned slash pine plantation. Vascular plants were sampled over nine trips from June to November 2013, and collecting will continue through April 2014. Voucher specimens will be deposited in the Valdosta State University Herbarium. A species-area curve was generated using data from similar inventories throughout the southeastern United States. This model predicted 325 vascular plant species for an equivalent area. As of November 2013, our inventory yielded 214 vascular plant species, comprising 150 genera in 69 families. Nine rare or unusual taxa listed by the Georgia Dept of Natural Resources were vouchered: Carex decomposita, Baptisia lecontei, Desmodium sessilifolium, Eustachys floridana, Palafoxia integrifolia, Peltandra sagittifolia, Pinckneya bracteata, Rhynchospora

microcarpa and Tillandsia recurvata. Populations of the non-indigenous invasive species Albizia julibrissin, Bidens bipinnata, Lonicera japonica, Ligustrum sinense, Lygodium japonicum and Paspalum notatum were also documented. Baseline data obtained through this study will be useful in developing informed management strategies for the site and will support ecological and other research at the LLFS.

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41 • Wesley M. Knapp

A Reexamination of *Juncus validus* Var. *Fascinatus* , a Texas Endemic, and Notes on Closely Related Species

Juncus section Ozophyllum (=Sect. Septati)is among the most morphologically diverse and geographically widespread sections of the Juncaceae. Taxonomic and nomenclatural problems abound. Juncus validus Coville, a species within this section, is a widespread and weedy species of the southeastern United States. A variety endemic to Texas, var. fascinatus, was described by M.C. Johnston in 1964. The recognition of this variety has been debated since its description. No detailed examination of this variety has been published. My preliminary morphologic analysis using new and previously published characters show var, fascinatus to be morphologically distinct from J. validus, Juncus validus var, fascinatus combines features of J. paludosus, J. polycephalos, J. scirpoides, and J. validus causing confusion when using existing keys. Ecological differences are also apparent. Juncus validus var. validus has shown a rapid and significant geographic range expansion throughout the southeastern United States and mid-Atlantic. This is illustrated nicely through mapping of the collection record. Given the rapid expansion of J. validus var. validus the nativity of this plant is questionable in many States where it is currently considered native. Juncus validus var. fascinatus is known from 21 counties in northcentral and southeastern Texas.

Maryland Dept of Natural Resources; 2 Wildlife and Heritage Service

42 • Richard Stalter1, Eric E. Lamont2

The Vascular Flora of Plum Island, Long Island Sound, New York

Plum Island, encompassing approximately 3.4 sq km, is located in eastern Long Island Sound, 41.18306Lat., -72.19028Long.). The purpose of this study is to document the vascular flora of Plum Island and analyze the island's plant diversity. No flora of Plum Island has been previously published and few botanists have visited the island. The vascular plant species on the island were collected monthly during the growing seasons from 2002 to 2008. The vascular flora of Plum Island consists of 414 species within 270 genera and 92 families. Two hundred sixty six species (64% of the total flora) are native to the island. The spore producing plants (monilophytes: ferns and fern allies) are represented by 10 species, the gymnosperms by six species, the dicots by 282 species, and the monocots by 116 species. Largest families include Asteraceae (61 species) Poaceae (60 species) and Cyperaceae (26 species). Largest genera include Carex (9spp.), Cyperus (8 spp.) and Juncus (7 spp.). With 23 documented rare taxa, the island has one of the highest concentration of rare plants in New York including seventeen extant taxa observed in the present study.

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43 . C. Theo Witsell, Brent T. Baker

Arkansas's Newest Herbarium: The Herbarium of the Arkansas Natural Heritage Commission (ANHC)

In this era marked by the closing and consolidation of all manner of natural history and life science collections, we report on the creation of Arkansas's newest herbarium. Since the establishment of the Arkansas Natural Heritage Program in 1973, staff botanists and ecologists have been collecting plant specimens from the state's rarest habitats and most pristine natural areas. These collections have provided documentation for many important new discoveries and some have served as type specimens for several new species.

Beginning in 2003, agency staff began keeping their specimens for an in-house herbarium which is now recognized by Index Herbariorum with the official acronym ANHC'. The goals of the collection are 1) to provide a high quality reference collection for work performed by Commission staff and their conservation partners, 2) to house voucher specimens for rare plant records in the database of the Arkansas Natural Heritage Program, and 3) to voucher plants of ecologically sensitive or otherwise significant lands, including those within the State's System of Natural Areas. While most specimens are from Arkansas, special care is being made to assemble a collection of plants from surrounding states that are not presently known in Arkansas but are likely to be found there. The collection currently includes more than 6,500 specimens. 61% of the specimens have been fully databased (all label data) and 100% have been partially databased (including, at a minimum, taxon name, county, collector, collection number, and date). Future plans include imaging the entire collection and expanding an exchange program.

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Arkansas Natural Heritage Commission, Little Rock, AR

44 • Brad R. Ruhfel¹, Heidi Braunreiter¹, William Ciocca¹, Claudia P. Bove², C. Thomas Philbrick³

Resolving the Evolutionary History of the Riverweeds (Podostemaceae)

Podostemaceae is the largest strictly aquatic flowering plant family. Their distribution is cosmopolitan in the tropics, though a few species occur in temperate regions, including one species native to the eastern United States. Several species are critically endangered and all species are restricted to rivers, an environment that is currently experiencing major human impacts, especially in tropical areas through the expanded use of hydropower. Recent molecular studies have sought to clarify relationships within Podostemaceae. Results indicate that several genera are not monophyletic as currently circumscribed and several areas of the phylogeny are unresolved. However, data from these studies have not been combined in one comprehensive analysis and several taxa remain unsampled. Recent field collecting efforts and laboratory work have allowed us to include unsampled Neotropical species in phylogenetic analyses and to add additional molecular markers for species included in prior studies. Here we report on two ongoing projects focused on resolving the evolutionary history of Podostemaceae using molecular phylogenetics. First, we conduct supermatrix analyses of all currently available molecular data. Second, we use newly collected data to further resolve relationships in the Neotropical clade. For the later analyses, we analyzed plastid and nuclear nucleotide sequence data using a maximum likelihood approach. Taxon sampling and resolution within the clade are greatly improved compared to previous studies and provide a strong basis for improving the classification of the family, which will directly aid conservation efforts. Results from this work will be used to guide our ongoing monographic efforts in the Neotropical clade.

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45 • C. Theo Witsell¹, Michael H. MacRoberts², Barbara R. MacRoberts², Brent T. Baker¹

The Vascular Flora of Blackland Prairie and Woodland Remnants in the West Gulf Coastal Plain of Arkansas, USA

The Blackland Prairie Ecoregion of the West Gulf Coastal Plain supports a number of plants, animals, and natural communities of conservation concern. This diverse mosaic of hilly, calcareous grasslands and woodlands, formed over Cretaceous marine deposits, has long been identified as a priority for conservation. Acquisitions by the Arkansas Natural Heritage Commission, The Nature Conservancy, the U.S. Army Corps of Engineers, and the Arkansas Game and Fish Commission have collectively protected more than 2,950 hectares of blackland habitats of varying quality in southwestern Arkansas and ongoing intensive management is restoring these lands. Despite knowledge

of and collections from these habitats by botanists for well over a century, no intensive floristic inventory of remnant grasslands and woodlands has ever been undertaken. The current work was conducted from 2001-2013 and relied on extensive field work as well as inventory of specimens in state and regional herbaria. The authors' collections focused on protected prairie remnants in the area but also covered selected roadsides, ditches, and other areas where prairie flora has persisted. More than 600 taxa of vascular plants were documented from remnant prairies and associated woodlands and wetlands in the region. This total includes 48 taxa tracked as state elements of conservation concern. These data provide the best available baseline for ecological restoration work in the region, which is gaining interest and support with several projects ongoing. A summary of this research will be presented along with an overview of the flora, geomorphology, and ecology of the region.

¹ Arkansas Natural Heritage Commission, Little Rock, AR; ² Bog Research, Shreveport, I A

46 • R. Austin Prater¹, Joey Shaw¹

The Vascular Flora of the Lula Lake Land Trust on Lookout Mountain in Walker County, Georgia

The vascular flora of the Lula Lake Land Trust (LLLT) was studied beginning in the fall of 2012 and continuing through 2013. The LLLT consists of 4,418 acres atop Lookout Mountain in Walker County, Georgia, which bounds the eastern edge of the Cumberland Plateau and borders the western edge of the Ridge and Valley physiographic province. A total of 30 collecting trips have been made with 449 species of vascular plants collected including one federally listed (*Spiraea virginiana*), two state listed (*Lysimachia fraseri*, *Silphium mohrii*), and three state records (*Calamovilfa arcuata*, *Solidago arenicola*, *Chelone lyonii*). 41 non-native plants (9% of the flora) were also documented including *Lonicera japonica*, *Ligustrum sinense*, and *Pueraria montana*.

¹ Dept of Biological and Environmental Sciences, University of Tennessee at Chattanooga, Chattanooga, TN

47 • Dwayne Estes¹, Aaron Floden², Theo Witsell³, Joey Shaw⁴, Brian Keener⁵

Untangling the Viny Viornas: Taxonomic Studies in the Genus&Nbsp; Clematis (Ranunculaceae)

Within the genus Clematis, 12 species with viny stems, small bell-shaped flowers, fleshy sepals, and hairy filaments, have been placed in subgenus Viorna, Molecular studies. using chloroplast and nuclear ITS DNA sequences, have found subg. Viorna to be monophyletic. All but one species are endemic to North America, where they occur in deciduous forests and woodlands of the eastern and south-central U.S. American viornas can be broken into three major species complexes based on morphology. Members of the Clematis viorna-reticulata complex are defined by variously pubescent and non-glaucous lower leaf surfaces and stem nodes and by having achene beaks prominently plumose. During the past 100 years botanists have not been able to reach a consensus on the circumscription of C. viorna and C. reticulata. This study seeks to examine the pattern of morphological diversity within this complex and to determine whether the numerous morphological variations are likely due to phenotypic plasticity or whether they likely represent distinct taxa. We examined herbarium specimens from 14 herbaria, conducted fieldwork in 11 states, and studied individuals in a common garden. We identified nine morphological variants within C. viorna sensu lato and seven morphological variants within C. reticulata sensu lato. Four of the variants within C. viorna sensu lato appear to represent undescribed species and five of the variants within C. reticulata sensu lato appear to represent undescribed species. We propose that the C. viorna-reticulata complex consists not of two species, but possibly as many as 16.

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48 • Darlene Panvini

Different Approaches to Service-Learning in Majors and Non-Majors Biology Courses

Developing meaningful service-learning experiences that connect science concepts to community engagement can be challenging for faculty in the sciences. Service experiences often aim to foster values of citizenship in students while meeting community needs and, at the same time, address the science learning objectives for the course. A one size fits all approach to service-learning may not work for courses aimed at science majors compared to courses predominantly for non-majors. Therefore a consideration of the students' motivation for learning science can help faculty develop service projects that tap into the academic interests of students. Science students often seek opportunities to explore career options, network, and solidify their basic science knowledge and skills while learning more advanced science concepts. Non-science majors are less interested in utilizing a science course for career building yet may have an interest in applied applications of science that enhance their overall science literacy. Examples from a botany course and a general education introductory environmental science course demonstrate different approaches to developing service-learning projects in science majors and non-majors courses that build on course objectives and assessments.

Dept of Biology, Belmont University, Nashville, TN

49 · Christopher E. Barton

Identifying and Addressing Nursing Students' Perceptions of Anatomy & Physiology Courses

Currently, a very large number of undergraduate nursing programs require one, or more, anatomy and physiology courses prior to entry into the nursing major. Though these courses will serve as the foundation for students' entry into the nursing major and its accompanying coursework, literature published over the past few years suggests that many first and second year nursing students maintain the perception that anatomy and physiology concepts could simply be learned within the context of their nursing curriculum. Further, data suggests that many of these same nursing students simply do not find value in taking a separate anatomy and physiology course. Furthering these perceptions is the fact that many anatomy and physiology courses are taught by instructors without a significant nursing background, often making it difficult for these educators to link topics and concepts with relevant clinical applications. Here, I would like to review recent literature outlining the primary perceptions that nursing students have regarding these courses. Additionally, I will offer practical ideas and examples used in my courses that might address and, ideally, alter the many perceptions that these students have towards early anatomy and physiology courses.

Dept of Biology, Belmont University, Nashville, TN

50 · Marlee B. Marsh, Allan Nail

Improving Lab Report Writing and Student Confidence Using Scaffolding Assignments and a Classroom Partner Program

Students generally need to work to strengthen their writing skills when they enter college, and writing in science is no different. Science writing is a technical skill and freshmen tend to struggle when composing first lab reports. Originally, a thorough and complete How to Write a Lab Report for Biology guide was composed and reviewed with students in small groups in the hopes of turning out polished lab reports at the end of the semester. However, many student products were below average (n=36, Avg=74) as students failed to follow guidelines in document. In search of a novel way to enhance student writing and reduce faculty-grading time, scaffolding methodology was employed in order to allow students to focus on how to write one section of the lab report at a time. Additionally, Biology faculty partnered with the college English faculty to assign a classroom partner to the class (CP). The CP was a science student skilled in writing who met with Biology

faculty and each member of the class for every writing assignment to provide peer review and guidance. After meeting with the CP and having at least one round of revisions, students turned in scaffolding assignments to professors for another round of feedback. At the end of the semester, student averages on the lab report were high (n=31, Avg = 91) and student feedback about the classroom partner were excellent.

Division of Business, Mathematics and Science, Columbia College, Columbia, South Carolina

51 • Chris Murdock, LaJoyce Debro

Inquiry-Based Alternatives to Traditional Introductory Biology Laboratories

Jacksonville State University has implemented an initiative to move toward a learningcentered campus. In order to facilitate this initiative, instruction that is supported by current methodologies and experiential learning is essential. During the past four years, the Dept of Biology at JSU has implemented a research-based laboratory course for freshman/ sophomore students that supports this learning-centered model. Specifically, this program received support from the Science Education Alliance of the Howard Hughes Medical Institute (HHMI). The goals of the project were to improve science education and to bring research into the undergraduate curriculum using isolation and characterization of mycobacteriophage as a unifying theme. A cross section of students with a diverse array of majors and prior experiences elected to participate. These students enrolled in the traditional freshman biology lecture, while participating in the research experience as a substitute for the traditional laboratory class. While the HHMI mycobacteriophage model has proven to be extremely successful in its application at JSU, it is conceptually applicable to almost any research project model for teaching the process of scientific inquiry. We describe here the implementation, results, and impact from the course. Further, we highlight elements of the project that proved to be particularly effective in promoting teaching and learning, along with those elements that are applicable to other projects and settings.

Dept of Biology, Jacksonville State University, Jacksonville, AL

52 • Cody L. Starnes, C. Brian Odom

No More Early Morning Virgin Hunts: Eliminating Male Offspring in Classroom Teaching Stocks of Drosophila Melanogaster, Using a Readily Available Male-Lethal Strain

One of the most aggravating, if not the most challenging, aspect of using Drosophila in undergraduate laboratories is the time that must be invested in harvesting virgin females for genetic crosses. Traditional methods are extremely labor and resource intensive, requiring large numbers of cultures and multiple fly clearings daily in order to acquire the requisite number of virgin females. Several genetic methods exist for producing strains in which only females emerge from pupation. Once highly effective method involves the use of males carrying, as a Y chromosome insertion, a heat shock triggered lethal gene. Heat treatments of these cultures cause the spontaneous death of all male larvae, thus eliminating the need to clear vials prior to harvesting females. Limited mutant stocks containing this male lethal are commercially available, but invariably come with the males eliminated. The generation of useful classroom strains of these flies using stocks readily obtainable from the Drosophila Stock Center will be discussed so that any mutations used in a teaching setting can be put into this male lethal background.

Dept of Biology, Wingate University, Wingate, NC

53 • Jennifer T. Thomas

Student Engagement in Upper-Level Biology Courses: The Role of the Professor

Creating an environment for student engagement in the classroom is a challenging goal for most professors. Studies indicate improved motivation and retention of information when students participate in activities that encourage analytical thinking, problem solving, and synthesis of information. Sometimes it is a struggle to choose teaching methods that are most effective, especially if our own experiences as biology students focused on a

lecture only approach. By using a decade of experience teaching two upper-level courses, Cancer Biology and Immunology, I hope to illustrate ways to engage students, focusing primarily on student independence and the professor as a facilitator of learning in the classroom, not an expert lecturer. Activities include textbook figure discussions, book discussions, and journal clubs.

Dept of Biology; ² Belmont University; ³ Nashville, TN

54 • Gary D. Grossman

The Use of Music Videos as Teaching Aids for a Course in Natural History

I developed and teach Natural History of Georgia, a large (140-200 student) lower division course that satisfies both environmental literacy and life science general education requirements at University of Georgia. The class is designed for non-science majors and deals with conceptual topics in ecology, evolution and behavior as well as field identification and basic biology of species. Examples of concepts include: speciation, natural selection, inter- and intraspecific competition, population regulation, mimicry, schooling and flocking, etc. In an attempt to provide innovative teaching aids for the students, many of whom do not have a strong science interest or background, I have developed several music videos on both conceptual topics and common species. Over the last two times that I have taught the class, students have responded that the videos in a strongly positive manner. The link to the videos is http://www.youtube.com/user/AssortedPieces. It is likely that these videos will be useful instructional aids for courses with similar topical material.

Warnell School of Forestry and Natural Resources, UGA

55 • Jennell M. Talley¹, Jennifer Hurst-Kennedy, Rebekah Ward

Using Caenorhabditis elegans to Teach Principles of Mendelian Inheritance in an Undergraduate Genetics Course

Georgia Gwinnett College (GGC) is a rapidly growing, open access school in the University System of Georgia (USG). The School of Science and Technology (SST) was awarded a grant by the USG to implement a four-year undergraduate research experience for all SST students. Previously, the lab component of genetics was online. To reach all biology students (sophomore/junior level) and increase the research experience, a genetics lab was designed and implemented using *C. elegans* as the genetic model system in the 2013-2014 academic year. Students were required to perform routine maintenance on worm stocks and determine modes of inheritance for different mutant alleles. Attitudinal surveys were given prior to and at the end of the lab experience. Results from attitudinal surveys will be discussed as well as the benefits and challenges of introducing *C. elegans* as the model organism of study in a genetics course.

¹ GA Gwinnett College

56 • C. Brian Odom

Two are Better Than One: Realigning an Undergraduate Biology Curriculum to Create a Two Semester General Genetics Sequence

By virtually any measure taken, genetics has been the most rapidly expanding biological discipline of the last 40 years. Why then, do introductory genetics courses still routinely occupy the same one semester slots they have held for the last 100 years? In 2013, the Biology Dept of Wingate University underwent a minor curriculum realignment in order to offer a two semester undergraduate genetics sequence. The specifics and advantages of this realignment will be discussed.

Dept of Biology, Wingate University, Wingate, NC

57 • Pearl R. Fernandes

Teaching an Online Lecture and Laboratory Course in Biology: Strategies That Work

As the demand for online courses increases, there is a need for faculty to develop new pedagogies and strategies for engaging students online, and create effective learning in

the virtual classroom. Having had to switch from face-face t to online teaching, the presenter will discuss what strategies work and what do not work for an online format in a Biology lecture and laboratory course. Student feedback on their experience in the online course was obtained via a pre and post assessment survey. Besides the presenter sharing her best practice strategies, the session will also engage the audience in an active.

South Carolina Honors College

58 • Lauren C. McCarthy, David R. Chalcraft

How Do Differences in Zooplankton Hatching Phenology and the Presence of Predators Affect Population and Ecosystem Level Properties of Aquatic Food Webs?

A growing amount of evidence indicates that both the order in which species enter into a community and the process of predation can play an important role in controlling community dynamics. Seldom considered is how differences in species hatching phenology and predation interact to affect algal resources and growth rates of later arriving species. To investigate these effects we conducted an experiment in mesocosms, where we manipulated the occurrence of different zooplankton species (fairy shrimp, clam shrimp and cladocerans) that differ in hatching phenology andthe presence or absence of predatory Notonecta. We found phytoplankton abundance declined through time at similar rates in all treatments except treatments that contained both fairy shrimp and clam shrimp. where there was little temporal change in the abundance of phytoplankton present. Otherwise the rate of change in phytoplankton abundance through time was similar among treatments, including treatments with no zooplankton, which suggests that each species alone had little influence on phytoplankton abundance. Though periphyton abundance increased through time the rate of change in periphyton abundance was similar across all treatments. The presence of clam shrimp slowed the per capita rate of cladoceran population growth when Notonecta were present but otherwise rates of growth did not vary among treatments. Together these results indicate that species differing in hatching phenology have little influence on ecological systems when alone, but interactions between particular pairs of co-occurring species can have important effects on both population and ecosystem level responses.

Biology Dept and Center for Biodiversity, East Carolina University, Greenville, NC

59 • Mehul Desai¹, Angela Burrow, James Russell

Ecological Significance of Sex Ratio Distortion on Parasitoid and Butterfly Populations

Trichogramma kaykai is very small parasitoid of the desert metalmark butterfly Apodemia mormo (Riodinidae) in the Mojave Desert and has been the focal organism for research on the evolutionary ecology of parasitism and sex ratio distorting microbial symbiosis for over three decades, T. kavkai is known to be infected with a unique sex-ratio distorting bacterial parasite in the genus Wolbachia. A central question in the evolutionary ecology of T. kaykai is the extent to which parasitism impacts the ecology of the host butterfly species and the sex ratio of the parasitoid wasp itself. In the summer of 2013 T. kaykai were collected from A. mormo eggs gathered in three sites in Mojave Desert for a ten-year analysis of changes in rates of parasitism and sex ratios. Parasitism rates had increased substantially in two of the three populations. In the third population a parasitoid species replacement appears to taken place within the past ten years. Sex ratio variation associated with Wolbachia infection showed little change in the ten year interval. The effect of Wolbachia-induced sex ratio distortion varied across T. kaykai subpopulations, with significant female-biased distortion observed in some, but not other populations. The impact of Wolbachia infection on rates of parasitism and sex allocation are discussed in the context of long-term analysis of the evolutionary ecology of this unique tripartite parasitic interaction.

School of Science and Technology, Georgia Gwinnett College, Lawrenceville, GA

ASB Paper Abstracts 273

60 • Michael J. Cherry¹, Robert J. Warren¹, L. Mike Conner²

Trait-Mediated Indirect Interactions Between Coyotes (Canis latrans) and White-Tailed Deer (Odocoileus virginianus)

Increasingly researchers acknowledge that non-consumptive predator-prey interactions can have profound effects. We propose that coyote (Canis latrans) effects on white-tailed deer (Odocoiles virginianus) may transcend direct mortality and that the non-consumptive interactions and their implications for deer populations and habitats should be investigated. We used a combination of monitoring data and experimentation to evaluate the potential for non-consumptive effects of coyotes on deer nutritional condition, reproductive strategy, and herbivory patterns on the Jones Ecological Research Center, in southwestern Georgia. We predicted harvest weights of 466 adult does from an 11 year period, and using an information theoretic approach we found support for the effects of predation risk (β =-1.42+0.69) and individual attributes (i.e., age [β =-1.44+0.31], evidence of lactation [β=-1.11+0.55]), but not resource availability. To evaluate the effects of predation risk on reproductive fitness we measured ovulations rates of does during a coyote decline. We found that during low coyote abundance, ovulation rates (1.5 CL/female deer) were 1.7 times greater than during high coyote abundance (0.9 CL/female deer, P = 0.03), despite increased deer abundance and similar nutritional condition. Increased recruitment was better explained by ovulation rates than survival rates of marked fawns. We previously demonstrated predator exclusion influenced deer foraging and therefore we measured the abundance of 10 selected browse species in predator exclosures and controls. Selected browse species were 1.3 times more abundant in controls (P=0.009). We suggest coyotes may have substantial non-consumptive effects on deer and their habitats in the Southeast, and that future research should investigate these interactions.

¹ University of Georgia; ² Joseph W. Jones Ecological Research Center

61 • Meredith Campbell¹, Lawrence E. Hurd¹, Pieter A. P. deHart², Joseph M. Taylor¹ Exploring the Trophic Niche of an Apex Predator: What Praying Mantids Really Eat

Predators influence community composition and diversity through direct and indirect interactions with other species in their food webs. The specific interactions of predators within food webs often are difficult to trace because most of them are generalist feeders on prey of more than one trophic level. Stable isotope analysis (SIA) offers a more direct measure of what a predator is likely to be eating than simple control-treatment differences in field experiments. We compared SIA for enrichment of isotopes of carbon and nitrogen (δ¹³C; δ¹⁵N) in lab-reared praying mantids (Tenodera aridifolia sinensis Saussure) that were fed known diets of arthropods from the most important feeding guilds (leaf chewers, phloem feeders, and carnivores) to field-caught mantids over a growing season. Lab animals exhibited distinctly different isotopic signatures for prey of different feeding guilds, with both δ¹³C and δ¹⁵N generally increasing with successively higher trophic levels of prey. Field-caught mantids, by contrast, showed high variability in this regard, which is expected for this extreme generalist predator. However, 515N showed a very definite pattern during growth and development of mantids, with eggs and adults having the highest values, decreasing from first to third instar as nymphs fed on lower trophic levels and increasing steadily thereafter, indicating a tendency to incorporate more carnivores (mainly spiders) in the diet as nymphs grew larger and matured.

¹ Dept of Biology, Washington and Lee University, Lexington, VA; ² Dept of Biology, Virginia Military Institute, Lexington, VA

62 • Daniel M. McNair

Red Imported Fire Ant and Henbit: A Possible Mutualism Between Two Invasive Species

Although red imported fire ants (Solanopsis invicta, Formicidae) have been shown to impact seed dispersal relationships between native ants and native myrmecochorous plants in complex ways, their effect on myrmecochorous invasive plants has not been

studied. A possible mutualism between *Solanopsis invicta* and the myrmecochorous henbit (*Lamium amplexicaule*, Lamiaceae) in their newly shared ranges is presented. The mutualism may involve not only seed dispersal but also increased success of henbitnear fire antmound edges. Results from the following experiments are presented: seed preference trials, digitally imaged plots measuring density of mature plants in relation to the center of fire ant mounds, and a seed bank analysis comparing the number of *Lamium* seeds found at mound edges and away from mound edges.

Dept of Biological Sciences, University of Southern Mississippi, Hattiesburg, MS

63 • Clifton B. Ruehl¹, David R. Chalcraft², Heather Vance-Chalcraft²

A Test of Ratio-Dependent Predation

Ratio-dependent predation theory proposes that predator-prey interactions are determined by the ratio of prey to predator density rather than prey or predator density alone. We tested this theory with a factorial experiment that included four prey densities and two predator densities in outdoor mesocosms constructed to resemble freshwater ponds. Twenty, 50, 80, or 110 squirrel tree frogs (Hyla squirella) served as prey and one, or two giant water bugs (Belostoma flumineum) served as the predator. We found evidence of density dependent mortality for both prey and predator, but no evidence of an interaction that would suggest ratio dependent predation. Tadpole mortality was 68% when initial density was 20 compared to 47% and 48% when initial density was 80 and 110 tadpoles, respectively, resulting in roughly 36% greater mortality at lower tadpole density. A single Belostoma resulted in 50% tadpole mortality, while two Belostoma increased tadpole mortality to nearly 60%. These results do not support ratio-dependent predation theory. Rather, our findings suggest that multiple predators have non-additive effects on prey and independent of predator density prey experience reduced predation risk at increasing prey density. We propose that predators function independently of prey to produce community structure.

¹ Dept of Biology, Columbus State University, Columbus, GA; ² Dept of Biology, East Carolina University, Greenville, NC

64 · Amber Kincaid, James E. Russell

Population Genetic Analysis of Trichogramma kaykai Using Molecular Markers

Population structure and genetic diversity are interrelated factors that play a significant role in the evolution and ecology of all species. We investigated the population genetics of Trichogramma kaykai, an endoparasitoid wasp which parasitizes eggs of the butterfly Apodemia mormo in the Mojave Desert. Trichogrammatid wasps are known to exhibit phoretic transportation. This poses the question of whether T. kaykai breeding is limited to local geographical areas or the larger host range. To answer this, A. mormo eggs were collected. T. kaykai were cultured and DNA extracted for population genetic analysis using the mitochondrial cytochrome oxidase subunit one (CO1) gene region, If T. kaykai breeding is limited to a local geographical area, then a subdivided population genetic structure is expected. Additionally, the relationship between Wolbachia-infected and uninfected T. kaykai is of concern due to the potential for Wolbachia-induced mitochondrial selective sweep, and reduced mitochondrial genetic diversity. Mitochondrial selective sweep, associated with strict coinheritance of Wolbachia and mitochondrial genomes, would be suggested by the presence of a dominant maternal line among infected sequences. We hypothesized that the T. kaykai population structure is not subdivided. Additionally, we hypothesized that the characteristic reduction in genetic diversity observed during mitochondrial selective sweeps has not started in the T. kaykai population. Phylogenetic analysis supported these hypotheses, with a population structure characterized by mutations divided amongst geographical locations, and Wolbachiainfected sequences with diverse mitotypes. An unexpected observation was multiple Wolbachia-associated mitochondria descended from uninfected lineages, suggestive of Wolbachia horizontal transfer.

School of Science and Technology, Georgia Gwinnett College

ASB Paper Abstracts 275

65 • Nigel Wolfram, Annette M. Golonka, Bettie Obi Johnson, Austin Blackwell

The Sweet Smell of Carolina Jessamine: Evaluating the Floral Scent Profile of Gelsemium sempervirens

Gelsemium sempervirens, commonly known as Yellow Jessamine or Carolina Jessamine, is a toxic perennial, distylous climbing shrub indigenous to the piedmont and coastal areas of the southeastern United States. The plant produces nectar and is pollinated by species of bees, wasps, flies, and butterflies. While floral scent is known to play an important role in chemical communication between flowering plants and their pollinators, there has been little research on the floral scent composition of this native South Carolina plant known for its sweet aroma. In order to identify the sweet scent of G. semperiverens, a solid phase micro-extraction and gas chromatography-mass spectrometry (SPME-GC-MS) method was developed in 2013 and optimized to identify the volatile organic compounds present in the flower. Initial test results have revealed a number of volatile organic compounds emanating from the flowers including; benzaldehyde, p-anisaldehyde. benzyl benzoate, benzyl alcohol, and acetophenone. Verfication of the floral scent compounds in this species is underway as well as identification of the floral components that contribute to the scent profile and the nectar inhabiting microorganisms. The results of this project will provide information on the scent compounds that contribute to the specific aroma of G. sempervirens, and ultimately contribute to understanding the pollination dynamics for this species.

Math,, Science, Nursing, and Public Health, University of South Carolina Lancaster, Lancaster, SC

66 • Claudia L. Jolls, Carol Goodwillie

The Tragedy of the Uncommon: the Reproductive and Population Ecology of Rare Herbs of Forested Eastern North America

For nearly a decade, we have attempted to summarize aspects of the population and reproductive ecology of herbs, including rare species and those of forested eastern North America, particularly the southeastern US (ca. 138 taxa). We have reviewed the published primary and other technical literature using search engines such as NatureServe and Web of Science as well as comparisons of the complete understory flora at different forested sites (Harvard Forest, MA and Crabtree Creek, NC). Several themes emerge from our efforts. Most understory herbs, including the rare, are perennial, hermaphroditic, with flexible mating systems. Two distinct mating systems occur, largely outcrossing as well as predominantly selfing; obligate self- or cross-fertilization is rare. A larger proportion has partial self-incompatibility, but complete SI is rare, often accompanied by vegetative reproduction. Floral displays (size and number of flowers) as well as pollination syndromes are diverse. Most understory herbs are visited by generalist pollinators; a few have distinctive specialists. Complete, reliable quantitative data for comparative purposes are limited, making inferences and generalizations difficult. A few rare taxa are distinctive in having their ecology well-studied, including seed germination and population biology, e.g., projection matrices; population viability analyses; integral projection models; life table response experiments). Common and rare herbs are understudied with respect to what regulates population size, the stability of population sizes, site-to-site variation, and methods for propagation needed for restoration. These typically long-lived, clonal, insectpollinated, outcrossing, and increasingly rare taxa of the understory also are acutely at risk due to fragmentation and climate change.

East Carolina University

67 • Carol Petricevic

Differences Among Populations of an Invasive Plant, Alliaria petiolata, In Germination and Growth in a Common Garden

Previous studies have shown the invasive biennial Alliaria petiolata is both phenotypically plastic and adapted to its introduced range. We conducted common garden and

germination studies to further investigate this with seeds collected from populations located along the plant's invasion route. The common garden plants were placed in plots at different elevations. The germination study seeds were placed in moist soil and cold-stratified for short, medium, and long cold stratification seasons. The results of the common garden study supported phenotypic plasticity for *A. petiolata* as a whole in most traits measured. Adaptation was indicated in a minority of traits, while other traits showed differences, but no patterns related to climate or range. In the germination study, most populations had near 100% germination for the long season. There were differences in germination rates for the shortened seasons, but they did not appear to be related to adaptation to cold-season length. Many differences in trait expression are likely due to genetic differences from founder effects with some possible adaptive responses; however, phenotypic plasticity is indicated for *A. petiolata* as a whole. This study supports the conclusion that *A. petiolata* is a habitat generalist.

Western Carolina University

68 • Blake W. Nelson, Andrew J. Jajack, Andrew E. Rosselot, Jay A. Yoder

Capacity of Cave Crickets to Carry Various Amounts of Fungi Depending on the Extent of Cave-Dependence: Observations Before Reports of Bat White-Nose Syndrome in the Cumberland Plateau

Cave visitors bring majority of fungi found in caves, a role played well by cave crickets (Hadenoecus) that leave and return to the cave frequently to forage that links the presence of these crickets in caves as a positive sign of a healthy cave. Mycoflora analyses and water balance experiments were conducted to examine whether different cricket species may function differently by the kinds of fungi they harbor in relation to their capacity to work effectively outside. In a north-south line of species along the Cumberland Plateau, H. cumberlandicus (Kentucky) had approximately two times more fungi on their surface than H. opilionoides (Tennessee) and H. jonesi (Alabama), with all having fairly the same fungal composition: probiotic Penicillium, Aspergillus dominating, Cladosporium, Fusarium, Mucor, Rhizopus as secondary components, and low frequency of variable components, yielding similar diversity indices. Risk of desiccation by having high water loss rate and high activation energy characterized H. opilionoides that is smaller in body size and H. jonesi that is troglomorphic-enhanced and has reduced pigmentation when compared to H. cumberlandicus that has lower water loss rates. Thus, crickets carry a large fungal load, and these fungi (mostly probiotics) are probably a method of defense against diseases, which is less important for highly cave-adapted crickets that spend more time inside the healthy cave. Nothing was recovered from cricket surfaces that resembled Pseudogymnoascus destructans, but since our collections white-nose syndrome has appeared in this region, so whether crickets can carry P. destructans should be checked.

Dept of Biology, Wittenberg University, Springfield OH

69 . MaLisa Spring, Katy Lustofin, Dave McShaffrey

Bee Diversity and Pollen Collection in Washington County, Ohio

We examined the bee diversity in Washington County, Ohio and the pollination services contributed by each species as denoted by the pollen found on the scopa. Lack of information about bee populations makes it difficult to notice change in populations. Furthermore, not many studies have examined the pollen collected by each individual bee. We collected bees at three sites in Washington County to get a representation of the diversity present. Bees were collected every two weeks from April 2013 to October 2013 using pan traps as well as occasional supplemental vane traps and sweepnetting. A total of 2,756 bees were pinned and identified to genus, and if possible, species. Over 33 genera of bees were collected representing over 80 species in five families. The most common genera were Andrena, Osmia, Lasioglossum, and Ceratina. Over 80 bees, predominately Andrena spp., had visible pollen loads; the pollen was identified to family. Floral constancy was determined by evaluating the different types of pollen collected on each individual. Andrena spp., were found to be more constant at the first sample date of

April 21st when *Claytonia virginica* is present. On later dates *Andrena* was much less constant, with several different types of pollen found on the individuals. We provide a baseline understanding of our current bee populations in SE Ohio as well as insight into the pollination services of each bee species. This data contributes to nationwide research about the current status of bee populations and pollination systems.

Dept of Biology and Environmental Science, Marietta College, Marietta, OH

70 • Angela K. Burrow, Mehul Desai, James E. Russell

Reproduction and Optimal Foraging in the Parasitoid Wasp Trichogramma kaykai

For some animals optimal foraging and reproduction are linked. A classic example of this linkage is found in parasitic wasps that complete development inside host organisms. We studied one such wasp Trichogramma kaykai, an egg parasitoid of the Mormon Metalmark butterfly. Apodemia mormo. For T, kaykai the foraging and reproductive environment primarily consists of patches of individual host eggs. Female foundress wasps measure host eggs, choose how many eggs to oviposit, and then continue foraging for additional hosts. Optimal foraging predicts that a foundress will maximize host utilization per unit time. The resulting F1 generation per host may have variable fitness contingent on brood size thus influencing ovipositing behavior. Field-collected parasitized A. mormo eggs showed variation for T kaykai brood size, suggesting alternative reproductive/foraging strategies. Two brood size (n=4.5) groups of thirty broods each were collected from the Mojave Desert. A. mormo host eggs were measured for size variation. Broods were supplied with nourishment and host eggs (Ephestia kuehniella) for two days. The F2 generation was assessed for total wasps emerged, females emerged, pupal stage wasps, and proportional fitness. We found no fitness differences between alternative reproductive strategies and no indication of host egg size-proportional fitness covariance. This suggests that individual offspring/brood fecundity for the two brood size groups examined is not influencing foundress oviposition behavior, however, in the highly variable natural environment other selective pressures may impact actual brood fitness. Further research is needed to determine additional factors influencing T. kavkai reproductive optimal foraging decisions.

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71 • Brittany D. Harry¹, Flor Acevedo², Michelle Peiffer², Shan Jin², Ketia Shumaker, Dr.¹, Dawn S. Luthe, Dr.², Gary Felton, Dr.²

Corn Earworm Saliva Induces Herbivore Defense Gene Expression in Corn

Corn is one of the most important crops worldwide. Corn earworm (Helicoverpa zea) herbivory on corn is costly in terms of the lack of crop yield that occurs and the damage it does, Caterpillar saliva is known to elicit plant defense response in several plants, but surprisingly the effect of H. zea saliva on corn defenses has not been reported. A series of experiments were conducted to determine the expression of several defense-related genes in Z. mays corn plant hybrid MC 4050 after herbivory by H. zea. We tested the saliva of the H. zea to determine if this factor is an elicitor of Z. mays defense gene expression in corn. Corn plants in the V3 stage were challenged with ablated (cauterized spinnerets) and non-ablated (intact spinnerets) H. zea caterpillars for 24 hours. Control plants were not exposed to H. zea caterpillars. The expression of plant defense genes (MPI, LOX3, RIP2) were analyzed by quantitative real-time PCR (qRT-PCR), using Actin as the endogenous control. We found significant differences (α=0.05) among treatments. The greatest gene expression was observed with non-ablated (intact) caterpillars. These results suggest that H. zea saliva is triggering defenses in corn. This information is important because corn is an important food crop worldwide and understanding the components of H. zea saliva that triggers corn defenses against this herbivore will help scientists develop novel insect control strategies. Future experiments will be aimed at identifying the components of H. zea saliva that induces defense gene expression in corn.

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72 • William Dees¹, Janle Theriot¹, Kathryn Leonards¹, Joel Byrne¹, Caleb Ardizzone¹, Adam Richard¹, Tatiana Estrada², Omar Christian², Cecilla Richmond³

The Effect of Plant Parts From Eight Plant Families on the Yellow Fever Mosquito, Aedes aegypti

We evaluated the effect of freshly-cut berries, flowers/petals, buds, leaves, stems, and/or seeds from eight plant families on female Aedes aegypti mosquitoes. Plant families included: Apiaceae, Apocynaceae, Asteraceae, Euphorbiaceae, Lamiaceae, Lythraceae, Malvaceae, and Verbenaceae. Standard plastic Petri dishes were used to hold mosquitoes and cut plant parts from 17 plant species. We recorded percent mortality at 24 and 48 h. Three tests per plant part using ten mosquitoes per test were conducted. A 10% sucrose solution served as a food source for mosquitoes during the Petri dish tests. Mosquitoes exposed to freshly-cut plant parts from Apiaceae, Asteraceae and Lamiaceae exhibited over 50% mortality when compared with the controls. Genera of interest include: Chrysanthemum (Chrysanthemum spp. - e.g., Spider Mum), Eryngium (e.g., Eryngium yuccifolium - Rattlesnake Master), Eupatorium (e.g., Eupatorium capillifolium - Dog Fennel), Rudbeckia (e.g., Rudbeckia texana - Texas Cone Flower), Monarda (e.g., Monarda fistulosa - Bee Balm), and Pycnanthemum (e.g., Pycnanthemum muticum - Blue Mountain Mint and P. tenuifolium - Slender Mountain Mint). Mosquitoes exposed to different parts of a chrysanthemum plant (flowers, buds, leaves and stems) exhibited 100% mortality in 24 h. Mosquitoes exposed to cut buds of Pycnanthemum muticum, P. tenuifolium, and Monarda fistulosa exhibited 100% mortality in 24 h. Several species are native to Louisiana and some are considered ethnobotanicals. These studies are part of the Louisiana Native Plant Initiative focusing on the effects of botanical components on mosquito behavior and development.

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73 • Daniel K. Hasegawa¹, Charles E. Beard¹, Konstantin G. Kornev², Peter H. Adler¹ Behavior Influences Permeability of the Butterfly Proboscis

The butterfly proboscis traditionally has been viewed as a drinking straw; that is, fluid uptake occurs at the tip, whereas the rest of the proboscis putatively is sealed along the seam of the two halves. To test the permeability of the putatively sealed area, we applied a traceable fluid of water and dye along the semi-transparent proboscis of buckeye butterflies (*Junonia coenia*). Proboscises were held in a straight position or a flexed position. Drinking was stimulated by applying 15% sucrose to the proboscis tip. Fluid entered the proboscis along the seam of the putatively sealed area within 10 seconds, as visualized with the dye. Significant amounts of fluid entered a flexed proboscis, but not a straightened proboscis, after 30 seconds. Thus, behavioral positioning of the proboscisflexing it versus straightening it—can influence fluid entry, rendering the entire length of the proboscis permeable or restricting permeability to the tip. The adjustable permeability, compared with the drinking straw model in which uptake is restricted to the tip, might enhance foraging efficiency and contribute to the diversification of Lepidoptera.

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74 • Raquel A. Fagundo, Zachary J. Loughman

Feeding Ecology of the New River Crayfish in Anthony Creek, West Virginia

New River Crayfish (Cambarus chasmodactylus) are restricted to the New River drainage of the Central Appalachians. Seasonal dietary habits were investigated in Anthony Creek, West Virginia via dissection of stomachs. Crayfish were collected monthly from May through October 2011. Animals were weighed prior to dissection and following removal of their stomachs to determine stomach mass. Total carapace length was measured and

used to place animals in respective demographic groups. Stomach content frequencies were obtained for the following broad categories: organic detritus, inorganic detritus, vegetal, and animal. Food items were identified to the lowest taxonomic level applicable. Additionally, the presence and weight of gastrolyths was noted. General linearized models (GLMs) were utilized to assess the affect of independent variables on feeding preferences. Analysis of proportional stomach content mass indicated that elevated foraging occurred across the population in May and October, with reduced foraging during mid-summer months. Organic detritus was consumed during all sampled months, and was the only item consumed by juveniles. Inorganic detritus was ingested sparingly, with the highest frequency of occurrence in August. Vegetation was primarily consumed by nonreproductive females in the months of June and July. Snails were the predominate animal ingested; benthic macroinvertebrates were rarely consumed. Increased ingestion of exuvia was strongly correlated to two mass molting events occurring in the population in both June and October. When present, exuvia usually occurred alongside gastrolyths. Results indicate New River Crayfish are feeding generalists, and food items vary largely according to season, reproductive state, and molt stage.

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75 • Kelly Anderson, Dwayne Estes

Riverscour Communities on the Locust Fork of the Black Warrior River System: Floristics, Vegetation, and Biogeography

Alluvial bars are deposits of stream sediments ranging in size from clay to boulder. These are open communities dominated by shrubs and herbs maintained by the occurrence of periodic flooding. Cumberland Plateau riverscour alluvium is notable for biological diversity and high occurrences of rare, endemic, and disjunct species. The Locust Fork of the Black Warrior River system in Blount County, Alabama lies within the southern Cumberland Plateau region of the Appalachian Plateau Province. Despite the biological significance of alluvial bars these communities remain understudied and rarely surveyed due to their relative inaccessibility. Threats from urban development, reservoir construction, invasive species and toxic runoff encroach; swift baseline documentation of existing flora and vegetation is critical. Herbarium collections provide a foundation for research in plant science and a physical permanent record of the occurrence of a species. Currently there is no known documented flora specific of the Locust Fork. Three objectives are primary to this research: (1) conduct a floristic vascular inventory; (2) characterize and map the vegetation community structure of exposed bedrock, cobble, sand, gravel, and boulder bars; (3) document and map distribution of significant rare and non-native plant species. Collection of plant species occurred from March - October 2013. Preliminary floral documentation of collected specimens and comparisons with college's results will ensue. Obtained results can be used to make connections on the status and significance of riverscour communities in southeastern North America. Conservation and preservation of biodiversity found within the Black Warrior River System are the ultimate goals of this

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76 • Jordan R. Gann, Lori L. McGrew

Effects of Glyphosate Exposure on Anxiety-Like Behavior in Danio rerio

Herbicides are frequently used in agriculture to decrease competition among plants and thus boost crop volume, growth, and quality. Glyphosate-based herbicides are the most commonly used herbicides internationally. Large amounts of research have concentrated on the effects of glyphosate-based herbicides on fish. Previously thought to be safe, numerous laboratory and field studies have confirmed that several preparations of glyphosate-based herbicides can be very toxic to adult *Danio rerio* (zebrafish) at concentrations that are comparable to levels found in the environment. Still, there has been no research studying the effects of glyphosate on anxiety. A laboratory study was

conducted in which adults of Danio rerio were exposed to glyphosate at a concentration of 10 mg/L for an expanse of seven days to investigate effects on anxiety.

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77 • Spencer S. Bell, Zachary J. Loughman

Comparative Life History of the Allegheny Crayfish Across West Virginia

Historically, crayfish life history studies focus on determining the life history of a single species at a single site. While this approach does provide biologists with valuable information, potential life history plasticity across a geographic gradient can go unnoticed. To determine if this dynamic occurs, seasonal life history parameters for male Orconectes obscurus (Allegheny Crayfish)were determined for North Fork and Short Creek, Ohio County, West Virginia monthly from March 2012 through April 2013. Reproductive and molt states, along with morphometrics were recorded for all individuals encountered. Form state frequency for males was determined monthly for Short Creek and North Fork populations, and compared to vouchered specimens maintained in the West Liberty University Astacology Collection collected across all three West Virginia physiographic provinces, to determine if geography impacts the life history schedule of male O. obscurus. Results indicated that at least four size cohorts were present within the Short Creek/North Fork populations monthly. These same cohorts appeared in populations outside the focal Short Creek/North Fork population, with males entering winter aestivation as form I and molting to form II by the end of May, and subsequently molting back to form I in late July. North Fork and Short Creek form frequency compared to males collected from across West Virginia indicated O. obscurus exhibits limited life history plasticity, and trends observed in the Appalachian Plateau (North Fork/Short Creek) were mirrored in the Allegheny Mountains and Ridge and Valley in West Virginia irrespective of latitude and elevation.

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78 • Neil Billington, Sirisha Bethala, Janet Gaston

Population Genetic Structure in Sauger: Management Implications

Predatory percid freshwater fishes such as sauger (Sander canadensis) are prized by anglers in most of the northern United States and Canada. State and Provincial management agencies need information that will help in the sustainable management of these resources, including knowledge of the genetic structure of their populations. In this study genetic variation and population structure of 1023 sauger in 12 populations from the Great Plains and Midwestern regions of North America were examined by protein electrophoresis of muscle and liver samples. Sauger showed a high level of population subdivision (Fst = 0.212), highly significant among population heterogeneity (heterogeneity χ^2 = 769.733, 64 df, ***), and there was little gene flow among sauger populations (Nm= 0.929). Mean heterozygosity (H) in sauger was 0.020 and the percentage of polymorphic loci was 8.11%. The 12 sauger populations were split into a western (Great Plains) group and an eastern (Midwestern) group based upon Rogers' genetic distances. Management implications of these results are that samples of sauger should not be transferred among populations as this will likely cause stock admixture with the possible loss of local adaptations.

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79 • Kristen T. Carlisle¹, James R. Rayburn²

Developing a Cryopreservation Protocol for Embryos of Xenopus laevis , the South African Clawed Frog

The development of a cryopreservation protocol for X enopus laevis embryos was investigated to increase the utility of X. laevis for research and educational purposes. This project evaluated the developmental effects of cryoprotectants, freezing and thawing procedures, and low temperature (exposure to 4°C) on early stage embryos, using the Frog Embryo Teratogenesis Assay-Xenopus (FETAX) protocol. These aspects have

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shown great importance in the cryopreservation of bovine, fish, mouse, and human embryos. *X. laevis*, the South African clawed frog, was selected for this research as it has historically been an important model organism used in developmental biology and molecular biology research. *X. laevis* embryos are easily manipulated and their developmental stages well established. Embryos were exposed to cryoprotectants, including DMSO, PVP, Galactose, and cryoprotectant cocktail. Exposed embryos were either cryopreserved in a Mr. FrostyTM freezing container or placed in an incubator for FETAX. Frozen embryos were thawed by various methods. For FETAX experiments, mortality, malformation, and length measurements were recorded for each experiment. The 96-hour LC50 (concentration to kill 50% of a population), 96-hour EC50 (concentration to cause malformations in 50% of a population), and Teratogenic Index (TI=LC50/EC50) were calculated using Bonferroni's multiple comparison test via Systat 13. For cryopreservation experiments, the percentage of embryos that remained structurally intact after thawing were recorded. Based on these results, an improved protocol utilizing cryoprotectant mixtures with low temperature exposure and a modified thawing procedure was developed.

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80 • W. Walker Stinnette¹, Jordan M. Ellington¹, Peter Van den Hurk², Dennis C. Haney¹

Relationships Between Land Cover, Water Chemistry, Biomarkers, and Fish Diversity in the Piedmont Region of South Carolina, USA

Row crops, livestock pastures, and forested areas are common in the Piedmont region of South Carolina, To determine the biological effects of exposure to agricultural runoff associated with these land covers, fish, and water samples were collected from streams in the Savannah and Broad River Basins in the summers of 2011 through 2013. Sampling sites were selected based on varying percentages of land cover devoted to pasture, forest, and row crop determined using land cover data generated by the United States Dept of Agriculture. Using a backpack electrofisher, seine, and dip nets, fish were collected, preserved, and identified to species in order to determine species richness, species abundance, and Simpson's diversity at each site. Preliminary measurements suggest fish populations were not significantly different between farmland, pasture, and forested streams. For biomarker analyses, previously visited sites, four in the Broad and nine in the Savannah River Basin, were revisited to collect live fish (genus Lepomis). Lepomis individuals were transported alive to the laboratory where they were anesthetized and tissue samples (liver, blood, and gall bladders) were removed for later analyses of glutathione-S-transferase and acetylcholinesterase activity as indicators of anthropogenic exposure. Water samples were tested for concentrations of nutrient chemicals (nitrate and phosphate) and turbidity. The biological effects, species information, and water chemistry were examined with respect to the varying percentages of pasture, forest, and row crop land covers to potentially uncover the presence of a relationship between the biomarkers, water quality, species diversity, and land cover activity.

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81 • Jordan M. Ellington, W. Walker Stinnette, Dennis C. Haney

The Effect of Agricultural, Pastured, and Forested Land Covers on Freshwater Stream Fish in the Piedmont of South Carolina

Land covers are affected differentially by anthropogenic influences. Two major anthropogenic problems found in streams are (1) channelization that removes the natural run, riffle, and pool patterns that many fish species depend on for survival, and (2) the runoff of excess sediment, fertilizer, pesticides, and other human-produced chemicals that can negatively influence biodiversity and organismal abundance. This study was conducted to examine the effects of pastured, forested, and agricultural land covers on

stream fish assemblages and life history characteristics, including age class structures of abundant fish species. We sampled from rural streams in close proximity to row crop agriculture, pastures, and forests in both the Saluda and Savannah River basins in South Carolina and hypothesized that areas with higher human usage (e.g., agricultural areas) would have lower fish abundance, diversity, and fewer age classes present. In conjunction with fish sampling, performed using a backpack electrofisher, seine, and dip-nets for 480 seconds of electrofishing time at each site, we also performed a grain size analysis of each stream site and collected water samples that were analyzed for temperature, pH, dissolved oxygen, and all major anions and cations. Fish were identified to the species level, measured for standard length, and weighed. Agricultural and pasture sites were found to consist of mostly coarse sand and the forested sites consisted mostly of coarse to medium size sand. Despite anthropogenic affects of farmland on streams, measurements of fish populations were not significantly different between farmland, pasture, and rural streams.

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82 • Gary Pandolfi, Michael M. Gangloff

Do Changes in Stream Physiochemistry and Landsuse Explain Appalachian Elktoe (Alasmidonta raveliana Declines in Western North Carolina?

The Appalachian elktoe mussel, Alasmidonta raveneliana, is endemic to upper Tennessee River Drainage streams draining the Blue Ridge Physiographic Province in North Carolina and Tennessee. Recently, Appalachian elktoe populations in some Western North Carolina streams have undergone dramatic, yet enigmatic declines and few parsimonious mechanisms have been proposed to explain the near complete extirpation of this already rare mussel from its key strongholds in high-quality streams. We used 40+ years of historic water quality data from EPA's Storet database to examine temporal changes in temperature, specific conductance, pH, nitrate and dissolved oxygen in 10 streams supporting A. raveneliana populations. In two streams that have seen recent A. raveneliana declines, the Little Tennessee and the North Toe River, we observed significant increases in summer and early spring temperatures. These trends were generally absent from streams with stable A. raveneliana populations, although the Tuckasegee River where the largest known A. raveneliana population currently resides, exhibited significant warming in 6 of 12 months across a 35+ year time span possibly foretelling the eventual collapse of this population. Examination of land use variation over the past 20+ years is ongoing but data suggest that heavily forested watersheds, such as the South Toe, may become key habitat strongholds for this already declining species.

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83 • Michael Perkins¹, Michael M. Gangloff¹, Nathan Hjohnson²

Phylogeny of the Critically Endangered North American Spinymussels

The spinymussels (Unionidae: Elliptio steinstansana, Elliptio spinosa, and Pleurobema collina) are critically endangered and endemic to the Southeastern Atlantic Slope. Although often characterized by the presence of conspicuous external spines, the spinymussels continue to be a source of taxonomic confusion. Key diagnostic features within the Pleurobemini (Elliptio and Pleurobema) are notoriously plastic, and at least two of the spinymussels (E. steinstansana and P. collina) share remarkably similar life history traits. Molecular analyses could improve characterization of these species, however genetic data is severely limited. We sequenced a ~1100 bp fragment of combined ND1 and COI mtDNA regions from Tar (E. steinstansana n=22), Altamaha (E. spinosa n=8), and James (P. collina n=55) spiny mussels using standard Sanger techniques. Preliminary phylogenetic analyses suggest E. steinstansana and P. collina form a distinct clade separate from any known Elliptio or Pleurobema taxa and likely warrant recognition as a new genus. Furthermore, these species are very closely related and may be conspecifics. Additionally, E. spinosa forms a clade separate from Elliptio and may constitute a monotypic genus. These preliminary results suggest a need to revise both taxonomic and

evolutionary paradigms for these taxa. Ongoing research (Spring 2014) will develop microsatellite markers for E. steinstansana and P. collina. The results of this research will provide conservation agencies with data needed to refine and develop more effective population management strategies for these threatened taxa.

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84 • Richard M. Wooten¹, Anne C. Witt², Chelcy F. Miniat³, Tristram C. Hales⁴, Jennifer L. Aldred⁵

Frequency and Magnitude of Selected Historical Landslide Events in the Southern Appalachian Highlands of North Carolina and Virginia: Their Relationships to Rainfall, Geologic and Geomorphic Settings, Ecohydrological Controls, and Their Resulting Effects on Forest Structure

Landsliding is a recurring process of mass wasting and sediment transport in landscape evolution in the Southern Appalachian Highlands (SAH). Debris flows, dominant among landslide processes in the Blue Ridge of North Carolina and Virginia, are triggered when rainfall creates excess pore-water pressures in steep, soil-mantled slopes. Rainfall from tropical and extra-tropical cyclones triggered hundreds to thousands of debris flows in 1916(NC), 1940(NC), 1969(VA), 1977(NC) and 2004 NC); whereas rainfall from other more localized storms in these and other years triggered tens to hundreds of debris flows. The orographic enhancement of rainfall combined with geologic and geomorphic characteristics makes certain landforms prone to debris flows. Field and GIS studies have helped quantify the magnitude of major debris flow events that have caused loss of life and property, and severely affected forest lands. Debris flows alter forest structure and hydrology by creating canopy gaps and disrupting aquatic ecosystems. Forest cover is an important stabilizing factor through precipitation interception, evapotranspiration, and root reinforcement. Root reinforcement reflects hillslope-scale differences in below ground biomass and tensile strength, and is directly affected by precipitation and soil moisture. Studies in SAH woody species show feed-forward responses of root tensile strength to changes in precipitation and soil moisture. Roots are weaker in convergent compared to divergent geomorphic features, and roots in wetter soils, i.e., after rain events, become weaker compared to when soils are drier. Thus, there is a feed-forward process in precipitation (and therefore soil moisture), root strength changes, and debris flow hazards.

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85 • David S. Leigh

Paleoenvironmental Range of Variation in Floods, Fires, and Biomes in the Upper Little Tennessee River Valley, Blue Ridge Mountains

Overbank alluvium from rivers and streams in the Upper Little Tennessee River valley provides a multi-millennial record of the range of variation in flooding conditions, bottomland sedimentation rates, fires (charcoal records), and biome changes that allow a long-term view of the regional range of variation of those natural systems. Several stratigraphic sections have been collected from vertical accretion floodplain sediments that allow paleoenvironmental insights over the past 2000 years. Sand sedimentology indicates intense flooding conditions around the beginning and end of the Medieval Climate Anomaly (ca. 800-1300 cal yr BP). Historical floodplain sedimentation rates are about and order of magnitude more than any prehistoric conditions, and there is no indication that prehistoric Mississippian and Cherokee agricultural activities accelerated erosion and sedimentation. A continuous 11,500 year sedimentation record was recovered from a meander scar in the Upper Little Tennessee River valley near Otto,

North Carolina. Analysis of charcoal and stable carbon isotopes from this stratigraphic section provides insights about past fire frequency and major shifts in biome composition with respect to C3 versus C4 plants in the watershed. The carbon isotopes indicate shifts in C3/C4 composition corresponding with the 8.2 ka climate change event, and during the late Holocene the charcoal and isotopic data are consistent with the idea that Native Americans used fire to manage forests and to expand agricultural activities that involved C4 plants (i.e. maize) during Woodland and later times. In summary, the paleoenvironmental record provides uniquely important background for framing and evaluating modern conditions in the region.

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86 • Peter A. Wilfahrt1, Julie P. Tuttle2, Peter S. White3

Assessing the Disparities and Similarities in Functional Diversity of Tree Communities Following Natural and Anthropogenic Disturbance

Natural disturbances act to reset affected patches of forest to earlier successional stages, creating a patchwork of forest ages and types across the landscape. Tree species often exhibit a trade-off between being able to rapidly colonize disturbed spaces or achieve competitive dominance over other species in the long term. Such trade-offs may be further defined in terms of the nature of the disturbance and how species withstand or respond to it. These trade-offs can be measured in the form of functional traits such as seed mass and wood density, and the trait space describing tree communities should vary predictably in response to disturbance. As the predominant forms of disturbance shift increasingly toward being caused by anthropogenic forces such as logging, a question emerges as to whether post-harvest forests occupy similar trait space as those created from natural forms of disturbance such as wind throws, fire events, and ice storms. This talk uses the USDA's Forest Inventory and Analysis database along with trait data for tree species to examine this question for central hardwood forests. It examines how the trait spaces of tree seedlings, saplings, and adult trees vary with respect to different types of disturbance, and whether there is a convergence toward trait-space similarity between natural and anthropogenic disturbance.

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87 • Julie P. Tuttle1, Peter S. White2

Changes in Disturbance and Structural Range of Variation in Great Smoky Mountains National Park, 1930s-2000s

When Great Smoky Mountains National Park (GRSM) was placed under strict protection in 1934, about 20% of the landscape was old-growth forest that had never been logged or farmed, and about 80% was second growth recovering from logging and settlement. Through the work of Whittaker (1956), the park's old-growth vegetation became an enduring textbook example of vegetation and species distributions, and we might expect that the structure of GRSM's old-growth forests today would capture the natural range of variation of these southern Appalachian forests, subject only to localized natural disturbances such as landslides, flooding, windthrow, ice storms, and fire. Despite protection, however, multiple indirect, diffuse anthropogenic disturbances--including exotic pests, fire suppression, atmospheric deposition, and changes in herbivory--have continued to impact both old-growth and successional GRSM forests. Here, we employ a mid-1930s vegetation survey and a compilation of more recent vegetation data sets (1970s-2000s) to compare the historic and present-day range of variation in GRSM forest structure and composition. First, we illustrate changes in disturbance by mapping the distribution of known natural and anthropogenic disturbances before and after park protection. We then compare GRSM forests of the 1930s and 1970s-2000s in both oldgrowth and second-growth areas, focusing on 1) the range of variation in basal area and density and 2) dominance and distribution of disturbance indicator species (i.e., based on shade tolerance and fire sensitivity). We highlight changes in these metrics for particular vegetation/site types and discuss the impact of ongoing, diffuse anthropogenic disturbance on GRSM forest structure.

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88 • Kendrick Weeks¹, Cathryn H. Greenberg², Susan C. Loeb³, Gordon S. Warbuton⁴

Disturbance-Adapted Animals: Habitat Requirements and Historic Distribution Across Central Hardwood Forests

Wildlife species are often categorized based upon their associations with vegetation structure and/or composition; those associated primarily with young, open, recently disturbed forest are often described as disturbance-adapted. Some species are disturbance specialists, where most of their requirements are met within recently disturbed forests; many others use both young and mature forests. Disturbance-adapted species may differ in their associations with specific structural features across the gradient of conditions created by disturbances. For example, Indiana bats rely on clumps of snags across the landscape and often roost in gaps or on forest edges; breeding eastern bluebirds require large, open areas to forage, and snags for nesting; indigo buntings are associated with open canopy forest having herbaceous and shrub components; and golden-winged warblers require open, grassy areas with some shrub and sapling cover in a forested matrix. Historically, this gradient of forest conditions was likely created by natural disturbances such as single-tree mortality, ice storms, insect outbreaks, high winds, and wildfires of different severities and frequencies, and by anthropogenic burning or clearing associated with Native Americans and later European settlers. We explore a suite of wildlife species that utilize different disturbed-forest structures and patch sizes, and discuss how their historic distributions and populations may have ebbed and flowed with frequency and size of natural and anthropogenic disturbances across the landscape. Finally, we investigate potential strategies that can be used to achieve the conservation of disturbance-associated wildlife while protecting biodiversity as a whole in central hardwood forests.

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89 • Scott E. Schlarbaum¹, Faith T. Campbell², Stacy L. Clark³

Changes in Forest Structure by Exotic Pests: Challenges in Policy, Biology, and Forest-Related Infrastructure

Forest ecosystem function and structure in the United States are being disturbed by a plethora of long-term and short-term impacts such as climate change and fragmentation due to urban development. Among the more immediate threats to the historic integrity of forests, is the progressive decimation of forest tree species by exotic pests. Over the last two centuries, these pests have transformed native forest species composition and structure. Some species, such as the American chestnut, are facing multiple exotic pests that reduce the probability of successful restoration. Preventing pest entry through strengthening of policies regarding importation and movement of goods within the country, developing sustained support for research to address each pest problem and restore affected species, and rebuilding the associated research and development infrastructure are discussed.

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90 • Virginia Dale¹, Dan Hayes¹, M. Joseph Hughes²

Potential Effects of Climate Change on Natural Disturbances in the Southeastern Upland Hardwood Forest Region

The spatial patterns and ecological processes of the southeastern upland hardwood forests are a function of climate and disturbance regimes. Global Circulation Models project an increase in temperature for all months in the southeastern United States, but changes in precipitation are less consistent (with some models projecting less precipitation and others projecting more). Even more unclear is how climate change might affect future trends in the severity and frequency of natural disturbances, such as severe storms, fires, droughts, floods, and insect outbreaks. Here, we use the Landsat record to map the spatial pattern and severity of broad classes of natural disturbances over the southeast region. The data derived from this map allow analysis of regional-scale trends in natural disturbances in the region over the last three decades. We discuss how observed changes in those disturbance regimes might project into the future, and the associated impacts on the patterns and processes in southeast upland hardwood forests.

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91 • Eric K. Zenner

Managing Central Hardwood Forests Within the Historic Range of Variation in Natural Disturbances

Forest ecosystems are dynamic; autogenic processes such as regeneration, growth, mortality, and decay keep forest composition and structure in a continuous state of change that is further modified by allogenic (natural and anthropocentric) disturbances. Disturbance regimes represent the interaction of frequent small scale events with infrequent, large scale events and are conditioned by landscape heterogeneity and feedbacks linked to current vegetation and prior disturbances. The complexity of natural disturbances is the crossroad to multiple pathways of forest succession, and facilitates long-term maintenance of ecosystem structure and processes. Historic range of variation (HRV) in natural disturbances attempts to synthesize the systemic variation in extent, magnitude, severity, frequency, timing, synergisms and feedbacks into a conceptual framework. Because disturbance regimes are tied to ecosystems, landscapes, and regions, they are not random, unpredictable or equally likely everywhere. Linking HRV to spatially delineated areas identified by climate, geology, topography, soils, and vegetation through an ecological classification system provides an ecological framework, within which silviculturists could then devise management strategies. Recognizing that not all disturbances provide the desired benefits and management outcomes, silvicultural strategies can be additive, compensatory or preventive vis-à-vis the HRV. Although the HRV concept has been challenged because HRV conditions may no longer exist due to climate change, atmospheric chemistry changes, and introduced species that are poised to transform all ecosystems, local analyses of HRV are critical to document the plasticity of forest community persistence under changing environmental conditions and provide guidance for silvicultural prescriptions.

Dept of Ecosystem Science and Management; Penn State University, University Park, PA 92 • Mason Brock¹, Dwayne Estes²

Flora and Vegetation of Riverscour Communities of Tennessee Caney Fork River

Riverscour communities are narrow, open communities, maintained by flooding, associated with rocky riparian zones on the banks of high-gradient rivers. These disjunct naturally open areas, dominated by graminoids, herbs, and shrubs, have an insular distribution and harbor rare, endemic, disjunct, and undescribed species. The Caney Fork River of Tennessee has significant areas of riverscour. Its Highland Rim portions contain the largest area of limestone riverscour in the Southeast; sandstone riverscour of its

Cumberland Plateau portion has populations of the rare Conradina verticillata and Spiraea virginiana. While sandstone riverscour communities have received some study, limestone riverscour has been poorly documented. The objectives of this study are to 1) document the vascular flora and 2) community associations of Caney Fork riverscour and 3) use these data to develop hypotheses about the biogeography of Caney Fork riverscour. Using aerial photography, study sites in each of two ecoregions were chosen: Rock Island State Park (Warren/White County-Highland Rim) and Scott's Gulf (White County-Cumberland Plateau). Since 2012, 224 species were collected from these sites representing 162 genera and 71 families. Twelve rare species were documented, including three state records (Apocynum sibiricum, Phyllanthopsis phyllanthoides, Symphyotrichum pilosum var. pringlei). The communities associated with limestone riverscour included limestone seeps, pools, glades and boulder bars. Sandstone communities included sand, cobble, and boulder bars. Plot sampling will be conducted in 2014 to further characterize the vegetation associations. This study provides baseline data for riverscour communities that will be compared with other studies of Southeastern riverscour.

287

¹ Austin Peay State University; ² Austin Peay State University and Botanical Research Institue of Texas

93 • Charles N. Horn

Challenges in Properly Identifying Species of Rhododendron (Ericaceae) in South Carolina

A taxonomic understanding of the genus Rhododendron (Ericaceae) in the southeast continues to change. Two new species have been described in the last 15 years. Toward attempting to clarify the number of species present, my work relates to axonomy in South Carolina (SC). Flowering individuals are readily identifiable, but a challenge with vegetative material. My goal is to identify material year round, including flowers (spring), fruits (summer) or flower buds (fall or winter). Variable morphological features add a challenge for identification. Two species that intergrade relative to features of bud scale surface hairs and marginal glands are canescens and periclymenoides. Field work has shown variation between populations and even within populations. A second challenge is in clarifying species over their geographical range. As an example, the minus complex appears to be represented by one species in SC. However, carolinianum, a cryptic segregate species known from higher elevations of North Carolina and Georgia is speculated to occur in SC. A third challenge has been in the recognition and identification of hybrids. Literature reports commonly include parental species involved in hybrids, yet definitive morphological features to recognize such have not been well documented. Hybrid individuals are recognized by some as having increased number of flowers per bud, unusual perianth colors, and intermediate pubescence patterns. Lastly, there are problems of using herbarium specimens, as they commonly lack macro scale features such as habit and population variation.

Biology Dept, Newberry College, Newberry, SC

94 • Jamie D. Smith, Conley K. McMullen

The Relationship Between Riparian Zone Width and Floristic Quality Along Streams in Shenandoah County, Virginia

Riparian zones harbor an above average plant biodiversity. This biodiversity is increasingly threatened by invasive species and human disturbance such as deforestation from agriculture and urban development. This study will determine the relationship between the size of the riparian zone and the floristic quality of its vegetation. A bioassessment tool, which utilizes plant community characteristics will, be used to obtain an estimate of habitat quality. This estimate, in turn will determine whether larger riparian zones provide more protection from the impacts of disturbance and provide higher quality habitats for plants. Vegetation plot data is currently being processed from five streams in Shenandoah County, Virginia.

Dept of Biology, James Madison University, Harrisonburg, VA

95 • Michael T. Lee, Alan S. Weakley

Classification of the Distribution Patterns of Plant Taxa Occurring in the Unglaciated Southeastern United States

Numerical classification has been used to identify and delineate groups of plants occurring together in the same physical location (plots), a basis for vegetation ecology community types. The approach uses repeated co-occurrence patterns of plants within plots to define vegetation types. These analytical tools can also be used on a regional scale to group plant taxa into distinct chorotypes, or repeated distribution and abundance patterns of taxa. Chorotype analysis is more commonly employed outside North America and for animal taxa. The goal of this presentation is to determine the number and extent of phytogeographic patterns (chorotypes) via hierarchical clustering and non-hierarchical partitioning. Our analysis includes approximately 7,000 plant taxa present in the unglaciated Southeastern United States, with their complete distribution and abundance patterns at the state - physiographic province scale. Each chorotype is defined in terms of the frequency of occurrence in each geographic unit (whether only one, several, up to all units), and the best fitting plant taxa occurring within the chorotype. We provide some initial and coarse-scale interpretation of the environmental and historical processes contributing to the existence of the patterns.

Dept of Biology, University of North Carolina at Chapel Hill, Chapel Hill, NC

96 • Emily L. Gillespie¹, Kathleen A. Kron²

Preliminary Phylogeny of the Southeastern Azaleas (Rhododendron Subg. Pentanthera)

The familiar deciduous azaleas are a group of approximately 16 closely related species currently recognized within the genus Rhododendron. Most species occur in the southeastern United States, but a number occur in the Pacific Northwest United States, in the Caucasus and in Eastern Asia. These plants, along with many of their evergreen relatives, are frequent targets for hybridization and genetic manipulation and therefore make up a substantial portion of the garden plant trade around the world. Despite this economic importance and general familiarity among botanists and the public, we lack an understanding of evolutionary relationships among the azalea species. The goal of the current project is to estimate evolutionary relationships among these species using molecular data and modern phylogenetic analyses. All named species of southeastern azaleas, as well as outgroup representatives from other Rhododendron and Ericaceae lineages, were included using freshly collected or herbarium materials. Data were chosen from both nuclear and chloroplast genomes, and subjected to different analytical frameworks to assess the preliminary behavior of six gene regions during analysis. Our initial results suggest that increasingly available data are rapidly improving our understanding of the relationships among the deciduous azaleas and revealing patterns of morphological and biogeographical patterns of evolution.

97 • Alexander Krings¹, Bruce K. Kirchoff², Piyush Agarwal³

A New, Open-Access, Visual Learning Tool to Promote Active Learning: Overview and Experiences With Its Application in Teaching Rare Plant Identification

Research in cognitive psychology over the past decades has established that domain experts (no matter whether physics, mathematics, or plant taxonomy) recognize features and patterns not observed by novices. This understanding has important ramifications for teaching. Studies have shown the importance of developing experiences designed to enhance student recognition of meaningful patterns of information. Field botany trips can be effective learning tools to teach plant identification because they help expose students to the variation in character states requisite for training their minds to recognize features and patterns like domain experts. After all, observational repetition in the field played a key role in field botany experts becoming experts in the first place. However, classroom or homework activities that mimic exposure to variation in the wild can also play an important

¹ Marshall University: ² Wake Forest University

role in developing expertise. These can even be necessary in cases where field labs are not possible, or where natural variation is not easily demonstrable given time constraints. The teaching of rare plant identification, targeted for aspiring environmental consultants or agency botanists, is one of these cases. We here present an open-access, html/javascript-based visual learning tool that facilitates species recognition through active image sorting exercises and discuss experience employing it at the advanced undergraduate and graduate level. The tool is freely available and is customizable to meet the needs of any activity for which sorting can enhance learning.

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98 • Judy Redden¹, Dwayne Estes²

Austin Peay Goes Digital: Developing an Online Herbarium for the Interior Plateaus Ecoregion

Austin Peay State University Herbarium (APSC) is the second largest herbarium in both Tennessee and the Interior Low Plateaus (ILP) Ecoregion with a strong focus on the flora of Tennessee, north Alabama, and central Kentucky. The mission of APSC is to serve as the primary reference herbarium for the ILP, to maintain a diverse collection of southeastern U.S. plants, and to use the collection to provide integrative training to a new generation of botanists through excellence in teaching, research, and outreach. APSC is in the process of implementing an on-line herbarium (http://nhm.apsu.edu/ collections/plants/) to accomplish this mission. The web site makes available highresolution images, taxonomic information, and locality data for approximately 50,000 specimens. This project implements a SilverBiology solution using a copy stand, camera, bar codes, and appropriate software. To date 20,000 specimens have been imaged and the underlying database contains 7,000 full specimen records. Optical character recognition (OCR) is currently being performed on specimen labels to collect skeletal data for the remaining 43,000 specimens. An overview of our methods and work flow rates is discussed. Preliminary data collected will be used to highlight the diversity of the collection and the relative importance of APSC to conservation and diversity studies within the ILP.

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99 • Devin M. Rodgers, Dwayne Estes

Vascular Flora and Vegetation of the Cumberland Riverscour Ecological System in Daddy's Creek Gorge, Cumberland County, Tennessee

The Cumberland Riverscour ecological system is a disturbance-prone riparian community found along rocky, high-gradient streams associated with deeply entrenched gorges of the Cumberland Plateau Ecoregion, Frequent high-intensity floods scour rocky riparian zones. retarding the growth of trees and favoring the development of a matrix of warm-season grasses, forbs, shrubs, and emergent wetland plants. Daddy's Creek in Cumberland and Morgan counties, Tennessee, has significant high-quality riverscour development. This stream system is rich in rare, endemic, and disjunct species, like the narrowly-endemic Cumberland rosemary (Conradina verticillata) and the Ouachita Mountains-disjunct, Cumberland sand reed (Calamovilfa arcuata). This study is designed to: 1) document the vascular flora of riverscour communities along Daddy's Creek, 2) delineate and characterize the various riverscour vegetation associations, and 3) map populations of rare and invasive species. Four preliminary trips to Daddy's Creek between June and September 2013 yielded 105 species in 90 genera and 39 families. Rare species found include the aforementioned taxa, a new population of Virginia meadowsweet (Spiraea virginiana), sand goldenrod (Solidago arenicola), an undescribed leatherflower (Clematis sp. nov.), an undescribed aster (Symphyotrichum sp. nov.), and a previously overlooked occurrence of the federally-threatened Little River arrowhead (Sagittaria secundifolia), the last a state record for Tennessee. Several vegetation associations were tentatively identified, including types associated with sand, cobble, boulder, and bedrock substrates; these will be assessed further in 2014 using quantitative plot sampling. We compare our results with findings of other Southeastern riverscour studies, concluding with a discussion of the biogeography of the Cumberland Riverscour ecological system.

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100 • Lytton John Musselman¹, Rebecca R. Bray¹, Peter W. Schafran¹, W. Carl Taylor²

Misconceptions About Quillworts (Isoetes, Isoetaceae, Lycophyta)

Quillworts, species of Isoetes, are poorly studied despite their widespread occurrence in the Southeastern United States. Four misconceptions about these puzzling plants are that hybridization is rare, asexual reproduction is unknown, scales are restricted to a few species, and diaspore is only by spores. Our studies show that virtually all quillworts hybridize and that hybridization is the rule rather than the exception. Like many ferns, quillworts exhibit reticulate evolution-interspecific hybridization and chromosome doubling followed by backcrossingwherever we have studied them. Asexual reproduction occurs by the lateral growth of the rhizomorph from which a meristem is established and roots and shoots arise producing independent plants that can break off and be carried by water. Every species of Isoetes we have examined has scales. Isoetes scales are small and are produced by the same meristem as the sporophylls. They are easily dislodged when the plant is collected. Scales have been confused with phyllopodia, which are indurate, often-reduced sporophylls. Quillworts produce scales whether or not they produce phyllopodia. Lastly, we have observed transport of young sporelings by water currents. Thus, our observations demonstrate that, in contrast to generally held views, species of Isoetes commonly hybridize forming interspecific polyploids, can reproduce asexually, produce scales, and can be distributed at the sporeling stage.

¹ Dept of Biological Sciences, Old Dominion University, Norfolk, VA; ² Smithsonian Institution, Washington, DC

101 • Alan S. Weakley, Michael T. Lee

Floraquest &Ndash; A New Mobile App for the Southeastern United States Flora

The Flora of the Southern and Mid-Atlantic States, by Alan S. Weakley and contributors, has become a primary resource for botanists and other professionals, amateurs, and students interested in the plant resources of the 14-state region of its coverage, because of its modern treatment of the rich flora of the region (7000 taxa), its detailed keys emphasizing vegetative characters, extensive literature cited, and detailed crossreferencing to other taxonomic and floristic treatments of the states, families, and genera of the area. For over a decade, it has been published annually in pdf and print form, but this does not provide optimal access to current taxonomic, nomenclatural, and identification information in an increasingly digital world. To meet this need, we are designing and will soon release FloraQuest, an app' closely based on the most up-to-date version of the Flora of the Southern and Mid-Atlantic States. Initially, the app' will be released on iOS (Apple) and can be used on iPads and iPhones. Features will include full access to the contents of the Flora, keys optimized for use on a mobile device, options to simplify keys based on location (GPS or user-entered) cross-referenced against documented distributions of taxa, illustrated glossary of botanical terminology used in keys, maps of distribution of all 7000 taxa, linked photographic and line-drawing illustrations, membership in FloraQuest user community and ability to post images for crowd-sourced identification, and option to submit observations for verification and provisional augmentation of distributional databases.

UNC Herbarium (NCU), N.C. Botanical Garden, UNC-CH

102 • Jeffrey Thomas

Queens Is Going to the Birds: Data Analysis in Courses Using Community Partners

Queens University of Charlotte recently established a relationship with the Carolina Raptor Center. The nature of this collaboration has grown and evolved over the course of a year and a half and has allowed us to incorporate real world research questions into several of our biology courses, including animal behavior, genetics, cell biology and independent studies. Students in an animal behavior class were introduced to a pair of nesting Bald Eagles at the Carolina Raptor Center. In class, they used streaming video of the pair to collect behavioral observations using an event recorder (JWatcher) to analyze patterns of parent-offspring vocal behaviors in these birds. The analysis of the behavioral data provided students with the ability to practice data collection techniques that emphasize inter-observer reliability and allowed for detailed analysis of a real-world behavioral question. The student analyses are shared with the Carolina Raptor Center to aid in the continued development of their conservation programs.

Dept of Biology, Queens University of Charlotte, Charlotte, NC

103 • Patricia A. Koplas, Jeffrey Thomas

Raptor CSI: Queens University of Charlotte

An important trend in undergraduate biology education is to shift focus from established pre-set experiments to inquiry-based investigations of real world research questions. The Biology Dept at Queens University of Charlotte has fostered collaboration with the Carolina Raptor Center to explore multiple aspects of the raptor population in the local ecosystem. The various pieces of the research project have been incorporated into multiple courses within the Dept curriculum. One specific project aims to characterize any existing tissue pathology in dead raptors to augment basic necroscopy observations and help identify cause of death. The Cannon Research Center is a second community partner providing both histological expertise and embedding and preparation of raptor tissues for histological staining. Initial tissue staining protocols were optimized by students working in both internship and independent study capacities. The next phase of the project is the inclusion of histological staining experiments in our upper level cell biology course this semester. Specifically, students will be given unknown tissue sections for staining and asked to identify the specific tissue of origin and any variation in tissue appearance. The long-term goals of this project are to incorporate histological techniques and analysis into the curriculum while collaborating with outside avian pathologists to optimally characterize pathology patterns in local raptor populations.

Biology Dept, Queens University of Charlotte, Charlotte, NC

104 • Jennifer C. Easterwood, Jeffrey Thomas

Girl or Boy? Molecular Sex Determination of Raptors in an Upper-Level Genetics Course

Queens University of Charlotte recently established a collaboration with the Carolina Raptor Center. One facet of this collaboration is to help the Raptor Center determine the sex of their rehabilitated raptors through a molecular sexing protocol. Many bird species lack sexual dimorphism and the direct observation of gonads is invasive. Given that females are heterogametic (ZW) while males are homogametic (ZZ), sex can determined through PCR using blood samples. Our upper-level genetics courses were provided blood samples from the Raptor Center. Over the course of the fall semester the students optimized the DNA extraction; PCR, and gel electrophoresis protocols. They were able to successfully identify the sex of four different raptors, an Eastern Screech Owl, a Red-Tailed Hawk, and two Bald Eagles, all species that have not been sexed using this protocol in previous publications. This information was sent to the Raptor Center to help with their breeding and conservation programs. The incorporation of this research project into a required course gave students experience with real-life science; many students expressed frustration as they optimized the DNA extraction protocol and then gratification

when they were able to obtain results. The long-term goal is for students enrolled in Genetics to not only continue the gender determination project, but to further optimize it so that DNA can be extracted from feathers rather than blood.

Dept of Biology, Queens University of Charlotte, Charlotte, NC

105 • Jimmy Davis¹, Darlene Panvini²

Linking Communication and Biology

The value of public communication about science is well-embodied in a slogan commonly used by the AAAS: Advancing Science, Serving Society as well as by AAAS programming such as the Communicating Science Seminar which focused this year on engagement with journalists, social media, and public events. Translating this emphasis on public communication to undergraduate Biology students was a primary motivator behind the development of an intentional linkage between two courses: a second-semester Biology course and a Sophomore-level Social Science course offered by the Communication Studies Dept which focuses on Science in Public Discourse. These inquiry-driven courses aim to give students both a detailed understanding of biological systems as well as a broader understanding of science in the public arena. The dramatistic model for exploring public discourse, known as The Pentad and developed by rhetorical scholar Kenneth Burke, serves as the organizing typology for the communication course and provides multiple points of connection to the Biology course. Details about the two courses, the surprising intersections between them, and the impact on student understanding of Biology and Communication Studies will be the primary focus of this presentation.

¹ Dept of Communication Studies, Belmont University, Nashville, TN; ² Dept of Biology, Belmont University, Nashville, TN

106 • Dr. Valarie A. Burnett

Building Scientific Literature Research and Presentation Skills in a College Setting

Biology students destined for Graduate School and professional careers will inevitably be expected to present their work on a regular basis. The more practice they have in researching literature and delivering their findings to an audience, the more polished these presentations will likely be. Therefore, I have incorporated research assignments into my courses to provide such practice. Students do two presentations. The first assignment is a group oral report. Working in a group is intended to allow students, who may have little to no experience doing this type of activity, to learn from the background and skills of others. The second project differs by semester. During Fall, each student researches a topic and presents a PowerPoint to the class. In Spring, students research an environmental topic in groups of four, write individual papers, and construct a group Poster. The Poster is presented at an Earth Day Poster Session attended by campus faculty, staff, and students. At the end of both terms, students answer questions about their experiences. both as a presenter and an attendee, to reflect on the activity and provide the instructor with insight and assessment of the assignment for future purposes. Most students are able to list several items they have learned and view the research project as a valuable. positive learning experience. Students who take two courses in sequence often show marked improvement in meeting assignment criteria in the second term. This Spring, the Poster Session will include Oral Presentations of original research and Posters in Mathematics.

Dept of Science and Mathematics, Newberry College, Newberry, SC

107 • Erika A. Scocco¹, Amee Odom², Greta Wood³

Integrating Google Sites Into the Old Paper Report Assignment

A Google site is a medium commonly used to create personal and professional websites at no charge to the individual. Such use of this medium can lead to promoting a student's achievements for application to professional or graduate school, or for employment. An upper-level Microbiology class was assigned to create a Google site based on a pathogen and disease, rather than complete a written paper assignment. The group of students

created various subpages that were to inform the general public about the pathogen and the disease. This assignment integrates modern technology with project-based learning so that students can familiarize themselves with Google services for future professional endeavors.

293

¹ Dept of Biology, Wingate University, Wingate, NC; ² Ethel K. Smith Library Director, Wingate University, Wingate, NC; ³ Reference Librarian, Mississippi State University, Mississippi State, MS

108 • Z. Carter Berry

The Importance of Fog as a Water Source in Southern Appalachian Cloud Forests

In cloud forests, fog water can provide a potentially important moisture subsidy to communities that are endemic to these habitats such as the threatened spruce-fir communities of the southern Appalachian Mountains. These mountain-top communities grow only above ~1500 m elevation, harbor the endemic Abies fraseri, and have been proposed to exist because of frequent cloud immersion. We utilized stable isotopes and mathematical mixing models to determine the relative contribution of fog water to saplings at the upper and lower elevational limits both in May (beginning of growing season) and October (end of growing season). Additionally, we simultaneously measured gas exchange and water potentials. Fog water contributed up to 31% of plant water at the upper elevation sites in May. High elevation plants of both species also experienced greater fog frequency and had greater cloud water absorption (14-31%) compared to low elevation plants (4-17%). Greater fog uptake occurred in May compared to October, despite similar rainfall and fog frequencies. High elevation saplings also had improved water status and photosynthetic rates in response to fog. These results demonstrate the important water subsidy that cloud immersion water can provide. With a warming climate leading potentially to increases in the ceiling of the cloud base and, thus, less frequent cloud immersion, persistence of these relic mountain-top forests may depend on the magnitude of these changes and the compensating capabilities of other water sources.

Wake Forest University

109 • Kaitlyn Schaaf¹, Rita Malia Fincher¹, Alex Gilman²

Costs of Chemical Defense and Ant Symbiosis in Two Rain Forest Understory Shrubs in the Genus Piper

The costs of plant defenses against herbivores and pathogens are commonly assumed to be associated with trade-offs in the allocation of limited plant resources to other plant functions, but costs and trade-offs have proven to be challenging to quantify and often are not detected in circumstances where theory predicts they should be substantial. In tropical environments, these costs and trade-offs are even more difficult to discern as there are many layers of complex interactions across trophic levels that complicate study. Most influential of these interactions are the widely varying relationships between insect herbivores and mutualists and their plant hosts. We believe that the variable results of studies that have attempted to quantify the costs and trade-offs associated with defense stem from the methods used to quantify defense and a lack of appropriate control of environmental conditions. In this experiment, we examined the varying response of two closely related species in the genus Piper (Piper cenocladum, which has a welldocumented ant mutualism with Pheidole bicornis and Piper imperiale, which is facultatively inhabited by ants) to different light, fertilizer and ant treatments in a factorial design. In order to examine how ant mutualism alters the trade-offs between defense and other plant functions, we measured plant growth, photosynthetic rate, chlorophyll content, and herbivory. We found that the growth of these two species is limited by different factors, with P. cenocladum being limited by nutrient availability and P. imperiale being limited by light availability.

Dept of Biological and Environemntal Science, Samford University, Birmingham, AL; Organization for Tropical Studies, Costa Rica

110 • A. Joseph Pollard

Facultative Hyperaccumulation of Heavy Metals and Metalloids in Plants

Approximately 500 species of plants are known to hyperaccumulate heavy metals and metalloids. The majority are obligate metallophytes, species that are restricted to metalliferous soils. However, a smaller but increasing list of plants are facultative hyperaccumulators that hyperaccumulate heavy metals when occurring on metalliferous soils, yet also occur commonly on normal, non-metalliferous soils. This presentation will describe the biology of facultative hyperaccumulators and the opportunities they provide for ecological and evolutionary research. The existence of facultative hyperaccumulator populations across a wide edaphic range allows intraspecific comparisons of tolerance and uptake physiology. This approach has been used to study zinc and cadmium hyperaccumulation by Noccaea (Thlaspi) caerulescens and Arabidopsis halleri, and it will be instructive to make similar comparisons on species that are distributed even more abundantly on normal soil. Over 90% of known hyperaccumulators occur on serpentine (ultramafic) soil and accumulate nickel, yet there have paradoxically been few experimental studies of facultative nickel hyperaccumulation. Several hypotheses that have been suggested to explain the evolution of hyperaccumulation seem unlikely when most populations of a species occur on normal soil, where plants cannot hyperaccumulate due to low metal availability. In such species, it may be that hyperaccumulation is an ancestral phylogenetic trait or an anomalous manifestation of physiological mechanisms evolved on normal soils, and may or may not have direct adaptive benefits.

Dept of Biology, Furman University, Greenville, SC

111 • Rachel L. McAlister¹, Duane A. Kolterman², A. Joseph Pollard¹

Intraspecific Variation in Nickel Hyperaccumulation in Populations of *Psychotria grandis* From Serpentine and Non-Serpentine Soils of Puerto Rico

Metal hyperaccumulators are plants that store heavy metals or metalloids in their leaves, often to concentrations much higher than in the soil. Most hyperaccumulators are obligate, occurring only on metalliferous soils, but a few species are facultative, occurring on both metalliferous and nonmetalliferous soils. Psychotria grandis (Rubiaceae) ranges from Central America through the Caribbean on many soil types, and is known to hyperaccumulate nickel on serpentine (ultramafic) soils in several locations. In this study, three Puerto Rican populations of P. grandis, one from serpentine soil, one from nonserpentine soil, and one from a geologically heterogeneous area were sampled to determine differences in foliar Ni concentration between populations, and between trees within populations. Approximately ten trees were examined at each site, with leaves from multiple branches collected from each tree. Nickel concentration in leaves was measured by atomic absorption spectrometry. There were significant differences in mean Ni concentration among the three sites. Unsurprisingly, the non-serpentine site was lowest (4,000 µg/g). The heterogeneous site had a mean Ni concentration of 2,224 µg/g, so it also exceeds the 1000 µg/g criterion for hyperaccumulation. There were significant differences in Ni concentration among trees within each of the three sites, with especially wide variation in the geologically heterogeneous site. A greenhouse propagation protocol was developed to allow rooting of semi-woody stem cuttings of P. grandis, and future studies will compare accumulation capacity of the three populations under uniform conditions.

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112 • Andrew E. Rosselot, Blake W. Nelson, Andrew J. Jajack, Jay A. Yoder

Common Treatments Applied to Honey Bee Colonies and Their Implications for Rise of Lethal Chalkbrood Disease

Chalkbrood is a fungal disease afflicting bee larvae; larvae turning into mummified, driedout shells that result from a takeover by the fungus (Ascosphaera apis) from inside out

characterize the disease. Beekeepers have observed a trend within their colonies of increased chalkbrood symptoms being present while they are using treatments that promote bee health, carbohydrate feeding supplements, antibiotics, and miticides. This was an in vitro fungal growth study, and we made it applicable to a field setting by using crushed bee larvae in agar growth media as a mock infection, strong chalkbrood-inducing temperature conditions (implementing cold- and heat-shocks that incite the disease), and treatment concentrations that beekeepers use, to explore whether colony treatments promote growth and establishment, leading to infection by A. apis. Growth of A. apis increased steadily from 25°C - 35°C, without a burst in growth, even in the presence, or absence of a cold- or heat-shock cue. Fumagillin, oxytetracycline, and tylosin antibiotics, seven different brands of high fructose corn syrup, and sucrose syrup, alone and in combination, did not accentuate or slow down fungal growth compared to water-treated controls. Formic acid and oxalic acid miticides severely inhibited growth of A. apis, We have no evidence that colony treatments trigger chalkbrood. The need for treatment is a sign of stress already present within the colony, and this stress allows for chalkbrood to perpetuate, which puts a priority on keeping bees healthy.

Dept of Biology, Wittenberg University, Springfield OH

113 • Hayden Summers, Kel Arlinghaus, Timothy Griffith

Will Geographic Range Shifts Impact Rates of Photosynthesis? a Study of Extended Day Lengths on Leaf Photosynthesis of a Commercial Corn Variety

As global temperatures continue to increase, the geographic range of commercially grown crops will shift towards higher latitudes. With a shifted geographic range comes longer day lengths that could potentialy alter vital vegetative developmental processes. More specifically, little is known about how differing day length cues will effect common crop varieties leaf development and resulting photosynthetic rates. Truckers favorite white corn variety was grown under three different day lengths corresponding to a southern portion, northern portion, and edge of the range. As day length was increased, the rates of photosynthesis also increased- a 46% increase in photosynthesis was observed from the southern day length to the range-edge day length. However, under longer day lengths, there was also a slight increase in rates of transpiration. These changes in rates of photosynthesis are associated with changes in leaf architecture. As stomatal indexes (number of stomata compared to epidermal cells) increased there was a significant increase in rates of photosynthesis, as well as higher rates of transpiration. This experiment is consistant with our previously conducted studies on other native species that show that increases in day length increase stomatal densities. Our results raise the possibility that as crop ranges shift north in response to global climate change, alterations in rates of photosynthesis and water loss may impact sustainable plant growth and yield.

Georgetown College, KY

114 • Alyssa L. Teat, Howard S. Neufeld

Physiological Responses of Miscanthus giganteus Under a Short Term Drought Scenario

Miscanthus × giganteus has emerged as a potential high-yield biofuel crop due to its ability to grow in marginal soils. However, water availability is reported as a limiting factor worldwide for biofuel crop production and drought conditions can significantly decrease productivity in Miscanthus. The goals of this study were to understand how Miscanthus responds physiologically to short term drought and whether biochar can alleviate drought stress by improving soil water status. Miscanthus rhizomes were grown for 100 days in either soil only or soil amended with biochar at a rate of 50 t ha⁻¹. Drought was induced on half of the plants by withholding watering and physiological measurements (gas exchange, plant water potential) were made every three days throughout the drought period and during a rewatering event. Biochar was found to play a minimal role in alleviating drought stress, and increased water status was seen only under well-watered conditions. Although volumetric water content began to significantly decrease immediately, most physiological parameters, including leaf water potential, photosynthetic rates and stomatal conductance,

did not significantly until water content had reached 35% of control levels 12 days after drought was induced. After rewatering, leaf water potential recovered to within 90% of predrought rates within one day, and gas exchange recovered within three days. No significant differences were seen in total aboveground biomass between any treatment combinations. The ability of *Miscanthus* to recover quickly suggests that drought impacts could be eliminated in a short time, contributing to its ability to grow on marginal soils.

Dept of Biology, Appalachian State University, Boone, NC

115 • Benjamin R. Montgomery, Brittany P. Twitty, Donathan S. Dendy

Petals Promote Delayed Self Pollination in Linum rigidum

The role of flower petals as pollinator attractants is clear. However, in some species, petals may also promote pollination upon abscission by causing anthers or pollen to directly contact the stigma. Linum rigidum (stiffstem flax) is an annual of dry prairies with large basally sympetalous petals. Given that the plants apparently invest substantial resources in petals, we were interested in why the petals abscise quickly, typically within several hours of anthesis. To test the hypothesis that petal abscission promotes delayed self pollination, we placed plants either in pollinator exclosures or exposed them to pollinators. Then around the time of typical abscission, we either removed petals or left petals intact to allow for potential petal-mediated self pollination, and we returned all plants to exclosures. Pollen receipt was greater for flowers with petals intact than those with petals removed both among flowers exposed to pollinators and flowers in exclosures. Fruit set was also higher for flowers with intact petals than those with removed petals, both among flowers exposed to and those excluded from pollinators, Intact petals were associated with higher seed set per fruit for flowers in exclosures but not for flowers exposed to pollinators, perhaps indicating that for flowers with few visitors, petal-mediated delayed pollination boosted pollen receipt enough to allow fruit formation but not enough to maximize seed production. Manually self-pollinated flowers exhibited the highest levels of pollen receipt, fruit and seed set. These results indicate that petals act as a mechanism of delayed self pollination in L. rigidum.

Division of Natural Sciences and Engineering, University of South Carolina Upstate, Spartanburg, South Carolina

116 • Pieter A. P. deHart1, Dana J. Morin2

Eating Off the Land: Exploring Regional Variations in Coyote Diets

The conservation and management of local ecosystems is often a daunting task, involving multiple variables ranging from life history characteristics of predators to seasonal climate shifts. This management is made even more difficult by missing or misleading information regarding trophic structure. To address this issue and fill a critical knowledge gap in Appalachian Virginia, we focused on identifying dietary variation in an important and burgeoning opportunistic predator in this system, the eastern covote (Canis latrans). To investigate the trophic role of the covote throughout this region, we examined the carbon and nitrogen isotopic signatures from the hairs of covotes captured across multiple habitats. We found wide variation in signatures of individual coyotes in both isotopes, with differences ranging up to 4.7% and 4.4% in d15N and d13C, respectively. These differences highlight foraging across multiple trophic levels, and may be dependent on the habitat characteristics of individual home ranges. Furthermore, the observed mean isotopic signatures for all coyotes ($d^{15}N = 7.72$, $d^{13}C = -23.07$) are consistent with diets dependent on small mammal communities, suggesting a need to reassess current predation models that assume eastern coyotes persist primarily on livestock and ungulates. However, seasonal dietary differences are difficult to elucidate from current results, as coyote captures are heavily seasonally dependent and may be temporally misleading. This study provides important isotopic evidence for the diet of top predators in this region, and recommends that regional variations in covote predation be considered to refine current management plans throughout Appalachia.

¹ Dept of Biology, Virginia Military Institute, Lexington, VA; ² Dept of Fish and Wildlife Conservation, Virginia Polytechnic and State University, Blacksburg, VA

117 • Joseph C. White, William K. Smith

Seasonal variation in water sources of the riparian tree species *Acer negundo* and *Betula nigra* in the southern Appalachian foothills, USA

Determining which water sources a plant accesses throughout an entire year is an important step in understanding how changes in source characteristics, such as water availability and quality, affect utilization by a plant. The current study examined the primary water sources of selected riparian species common in the foothills of the southern Appalachians, Acer negundo and Betula nigra, during the phenological stages of spring leaf bolt, flowering, and leaf senescence/abscission. Source utilization was monitored monthly by comparing the stable isotopic composition of water samples taken from woody tissue to those collected from possible water sources. Throughout the year, both species used a combination of deep ground and shallow soil water sources, with a greater reliance on deeper sources during the late growing season. Water extracted from B. nigra was typically more depleted in δ^2 H than all collected sources, while values from A. negundo were more variable throughout the study period. Intraspecifically, isotopic values did not vary on a monthly or seasonal scale for either species (P>0.56), while interspecific values were different only at December, January, and July samplings (P<0.02). Strong positive relationships between air temperature and isotopic values of both species (P<0.04) were also found and may be due to increased evaporation of moisture from the upper soil layers, which both species appeared to use most of the year.

Dept of Biology, Wake Forest University, Winston-Salem, NC

118 • Tori M. Brenner, Josh Smith, John Quinn

Using Optimal Foraging Theory to Assess the Conservation Value of Managed Ecosystems

With the United States' growing population, an increasing need for farmland has led to the destruction of native prairies. These prairies act as a breeding and foraging environment for migratory birds, including the Bell's Vireo (Vireo belli). Because large-scale prairie preserves are not economical, it is essential to determine what factors are necessary to optimize foraging abilities of nesting birds while minimalizing the space needed. Optimal foraging theory suggests that nests surrounded by native vegetation would be less susceptible to predation or the environment because the adults would spend more time on the nest and less time foraging, leaving them fed and able to protect their young. In order to accomplish this, over two years Bell's Vireo nests were identified on both prairies and farmland and movements were film during egg laying and fledging periods. In particular we filmed time adults spent away from the nest. By collecting data on the surrounding landscape and analyzing video to determine how much time adults spent on each nest how the type of surrounding vegetation correlates to foraging efficiency. Preliminary analysis suggests that more time was spent away from the nest when embedded in native grasslands. These data suggest that conservation of the Bell's Vireo may be effective in managed ecosystems.

Dept of Biology, Furman University, Greenville SC

119 • Thomas A. Maigret¹, John J. Cox¹, Dylan R. Schneider², Christopher D. Barton¹, Steven J. Price¹, Jeffrey L. Larkin²

Effects of Timber Harvest Within Streamside Management Zones on Salamander Populations in Ephemeral Streams of Southeastern Kentucky

Habitat loss and fragmentation are two of the most important causes of global population declines and extinction of amphibians. Forestry is an important extractive, economic activity to many human economies, but it can be detrimental to ecosystem function and species viability therein. Salamanders comprise a significant amount of forest community biomass, and given their sensitivity to environmental stressors, often serve as important indicators of declines in forest ecosystem function. Several studies have focused on the

impacts of timber harvest on salamanders inhabiting perennial streams, the findings of which have helped inform timber best management practices in the U.S. Headwater streams and associated riparia account for a small fraction of the total landscape, yet these features are critical to the functioning of forested ecosystems; however, few have examined how timber harvest impacts salamanders in or near these areas. Our objective was to investigate the effects of three different silvicultural treatments, each involving different streamside management zone (SMZ) characteristics, on salamander communities in ephemeral streams. Data were collected by regular checks of pitfall traps, coverboards, and transect searches. Using both pre- and post-harvest data, abundance estimates were acquired using binomial mixture models. Declines in some species of terrestrial and stream-breeding salamanders were detected, and were shown to be likely related to characteristics of the corresponding silvicultural treatment. We suggest that application of modest SMZ regulations to ephemeral streams would likely reduce or eliminate alleviate salamander declines in these important headwater areas.

Dept of Forestry, University of Kentucky, Lexington, KY; Dept of Biology, Indiana University of Pennsylvania, Indiana, PA

120 • Meaghan L. Fabrycki, David Vandermast

Patterns of Tree Mortality and Replacement on Elon University Forest

Forests of continuity (FOC) are underappreciated and poorly recognized resources in successional landscapes. An earlier study described 6 ha of forest within the boundaries of a 22.5 ha old farmstead that is now Elon University Forest (EUF), with the compositional and structural characteristics of a forest that appears to have never been clearcut. The trees in this patch of forest are common late-successional species, are large and old for their species, and tip-mound depressions and standing dead trees indicate that succession here is dominated by gap-dynamics rather than response to historical clearcutting. To further our understanding of FOC, this study compares sapling (stems >1.4m tall and <10 cm dbh) composition and structure between the FOC and the earlier successional forests surrounding it on EUF. Our results indicate that the FOC has a significantly different sapling population than forests recovering from clearcutting. In particular, the FOC has more saplings (3295/ha vs. 1838/ha, p=0.036) that are more likely to be shade-tolerant, late-successional species such as mockernut hickory (Carya alba) and white oak (Quercus alba) than the younger forest. In contrast, the younger forest had far more yellow-poplar (Liriodendron tulipifera) and red maple (Acer rubrum). FOC also had higher diversity, more sapling species and lower evenness than did the younger forest. NMS ordination and cluster analysis on sapling composition grouped plots in the FOC as distinct from the younger forest plots.

Dept of Biology, Elon University, Elon, NC

121 • Rob Hopkins

Biodiversity Conservation in Wales, U.K.: DNA Barcoding Applications and Implications

In this paper I present the results of a research review study completed while a fellow at the Madog Center for Welsh Studies at the University of Rio Grande. The particular emphasis will be DNA barcoding efforts and related applications. Wales is the first country in the world to successfully barcode all of its native flowering plants and conifers. Resultantly, many research projects and conservation initiatives have been developed using DNA barcoding as the primary platform. These include efforts aimed at better understanding pollinator-plant interactions using barcoding to identify source plants of pollen grains being carried. Also, the technology is being applied to guide landscape restoration programs by identifying plant seeds preserved in soil profiles. More practical applications include the identification of species, such as the hawkweeds, which are very difficult to distinguish based on morphological characters. I conclude with a brief discussion on the uses of DNA barcoding in conservation and environmental management efforts in the United States and potential implications for biologists.

Dept of Biology, University of Rio Grande, Rio Grande, OH

122 • Geoff Call

Plant Conservation Under the Endangered Species Act: Proposals to List Three Plants as Endangered and Designate Critical Habitat

In August of 2013, the US Fish and Wildlife Service proposed to list three plants from the Southeastern US - *Physaria globosa* (Desv.) O'Kane & Al-Shehbaz (Short's bladderpod), *Helianthus verticillatus* Small (whorled sunflower), and *Leavenworthia crassa* Rollins (fleshy-fruit gladecress) - as endangered and to designate critical habitat for these species under the Endangered Species Act of 1973 (the Act). I will present information about these species' distribution and habitats, threats and conservation efforts affecting them, and the process by which species become protected under the Act.

US Fish and Wildlife Service, Tennessee Ecological Services Field Office, Cookeville, Tennessee.

123 · Jesse M. Wood, John E. Quinn IV

A Multi-Scale Analysis of the Effects of Local- and Landscape-Level Habitat Variables on Avian Cavity-Nesting Species Occupancy

In the last four decades, the southeastern United States has experienced a regional landcover transformation trend of forest-cover loss, driven by urban development and land-use demands, with the pine-and-mixed-hardwoods Piedmont region experiencing the greatest net change of the eastern ecoregions. The Brown-headed Nuthatch (Sitta pusilla) and other avian cavity-nesting species are among the most threatened as their reproductive success is thought to depend on mature old-growth pine stands. Thus data are needed to aid in development of conservation strategies of suitable remaining habitat, especially in novel urban and managed ecosystems. We conducted point-count surveys and utilized unmarked package in program R to compare binomial-binomial N-mixture models to determine the relative effect of patch- and landscape-scale drivers of species occupancy. The occupancy of Brown-headed Nuthatches (S. pusilla) in urban and peri-urban landscapes suggest that many urban ecosystems are of unexpected high quality and may provide an important refugia for biodiversity. Patch-level variables like density of pines and patch area and landscape-level variables like amount of pine habitat within 500m and system type were featured in the strongest predictive models of nuthatch occupancy. By contrast, the best occupancy models for the widespread generalist Carolina Chickadee (Poecile carolinensis) species primarily featured indicators of patch-quality like canopy cover, canopy height, and stand density. By identifying factors that limit or predict occupancy for ecologically sensitive species, we can build a comprehensive model of species occurrence and contribute to regional conservation efforts of both habitat and biodiversity, even in human-dominated systems.

Biology Dept, Furman University, Greenville, SC

124 • Crystal A. Chambers

A Survey of Potential Threats and Population Dynamics of the Evergreen Quillwort (Isoetes hyemalis)

Quillworts are spore-bearing lycophytes with grassy, spikelike leaves and are native mostly to swampy, cooler parts of North America. *Isoetes hyemalis*, commonly known as the evergreen quillwort, is a member of the Isoetaceae. The species ranges sporadically through the Coastal Plain and Piedmont physiographic provinces of Georgia, Florida, Alabama, North and South Carolina, and Virginia. This species has been proposed for protection by the Center for Biological Diversity under the Endangered Species Act of 1973. Currently, there are only two small populations of *Isoetes hyemalis* in the state of Georgia. Neither of these populations are on conservation land. The purpose of this research is to survey the remaining habitats of *Isoetes hyemalis* in the state of Georgia, to identify patterns in genetic variation within and among different populations, and to determine any present threats. Two of the objectives of this research effort are to define and map where *Isoetes hyemalis* occurs using Global Positioning Systems (GPS) and

Geographic Information Systems (GIS) to identify what may be controlling its distribution and current threats. We will be using Polymerase Chain Reaction (PCR) to amplify and sequence selected DNA markers. Next we will analysis and compare ecological and evolutionary questions within the *Isoetes* genus in the Southeastern States. This research will provide information that can be used to prioritize conservation efforts.

Georgia Gwinnett College, GA

125 • Kendell R. Bennett, Laura E. DeWald

Genetic Variation in Mountain and Coastal Fox Squirrel Populations

Eastern fox squirrel (Sciurus niger L.) populations have declined due to habitat loss and encroachment by other squirrel species. In North Carolina fox squirrel populations currently only exist in the Coastal Plain and NE region of the western mountains. Within these two areas, fox squirrel habitat exists as isolated pockets separated by areas of unsuitable habitat. This separation makes fox squirrels vulnerable to loss of genetic diversity associated with small population sizes, genetic drift and lack of gene flow. To determine if these effects are causing populations of fox squirrels in North Carolina to diverge genetically, genetic structure among and within populations was quantified using seven microsatellite loci from DNA extracted from muscle tissue of squirrels accidentally killed by cars and preserved tissues from the NC Museum of Natural Science. Amplified DNA was sequenced and fragment length used to distinguish different alleles within and among individuals. Allelic data were used to calculate Wright's F statistics to compare genetic diversity within and between the mountain and coastal fox squirrel populations. Results will be presented summarizing the impact of isolation, genetic drift and lack of migration via the degree of differences among populations in allelic diversity as indicated F_{ST} values where a higher value indicates development of population structure. This information can be used to determine if and where barriers to gene flow exist, as well as determine candidate donor populations if it is decided that fox squirrels should be relocated within the state.

Western Carolina University

126 • Emma Sheffield¹, Rita Malia Fincher², R, Scott Duncan³

Initiation of Prescribed Burning May Initially Delay Mountain Longleaf Pine Regeneration

Prescribed burning is a widely accepted method of preserving and restoring longleaf pine ecosystems. This study examined the effects of introducing infrequent prescribed burning on longleaf pine seedling and sapling density in Oak Mountain State Park. In order to understand how fire may interact with microclimatic variables, we examined relationships between slope aspect, temperature, light availability, soil moisture, and juvenile longleaf density in burned and unburned plots. In this site, fires had been suppressed for many decades and the initial burn was quite hot, especially on the southeastern slopes. We found that juvenile density was dramatically higher in unburned southeast-facing slopes than the other burn/aspect combinations. Canopy cover was lower in southeastern slopes, burned plots, and above seedlings as opposed to random locations. Average daily high temperatures were much higher in the burned plots. Leaf litter depth and moisture were lower in the burned plots. The burned plots had an overall microclimate more suitable to longleaf recruitment and still had extremely low seedling and sapling density, indicating that the initiation of burning in forests where fire suppression has been a long standing policy may be associated with initial declines juvenile longleaf density.

¹ Eckerd College, Petersburg, FL; ² Dept of Biological and Environmental Science, Samford University, Birmingham, AL; ³ Dept of Biology, Birmingham Southern College, Birmingham, AL

127 • Ashley D. Montgomery, Laura E. DeWald

Predicting Suitable Habitat of Federally Threatened Species Isotria Medeoloides (Pursh) in the Southern Appalachian Region Using Maxent Model

Isotria medeoloides (Pursh) Raf. (small whorled pogonia) is one of the rarest orchids in the eastern US and is currently threatened by habitat loss in the southern Appalachians. The purpose of this study was to predict potential suitable habitat of Isotria medeoloides by creating a regional habitat model that will help focus future surveys and conservation efforts in the region. Maxent model was created to predict potential suitable habitat in the southern Appalachian region of NC, SC, TN, and GA. Habitat characteristics were measured at 10 extant locations and this information was combined with digital environmental variables selected based on field habitat assessments to develop the habitat model. Habitat assessments indicated Isotria medeoloides presence was associated with mid-successional, mixed-deciduous/coniferous forests; sparse ground cover; features and disturbance creating persistent canopy gaps; acidic soils covered in leaf litter that contain an impervious laver; and topographic positions at the base of steep slopes or on benches at mid-slope positions. A jacknife test evaluated the importance of the digital environmental variables on the predicted model. The Maxent model had high predictive performance with a statistically significant AUC value >90. Suitable areas, as predicted by the regional model, will be surveyed to find new Isotria medeoloides populations. Results from the upcoming field surveys will be used to determine if the Maxent modeling approach is useful for predicting suitable habitat for the rare Isotria medeoloides in the southern Appalachians, where few location records are available.

Dept of Biology, Western Carolina University, Cullowhee, NC

128 • J. Christopher Havran¹, Kirk A. Stowe²

Educational Opportunities at Biological Field Stations of the Southeastern United States

Biological field stations serve as important sites for biological research, education, and conservation. The Southeastern United States is host to many field stations that offer access to a variety of terrestrial, freshwater, and marine ecosystems. Many field stations offer educational opportunities that can enrich undergraduate and graduate student curricula. The Education Committee of the Association of Southeastern Biologists has organized a symposium to highlight educational programs at Southeastern field stations that offer access to a variety of different ecosystems. We will introduce field station representatives or experts from Kentucky, North Carolina, South Carolina, Mississippi, and Florida who will provide presentations that focus on the educational opportunities at their particular field station. The symposium will end with a question and answer session, with all representatives involved, that will emphasize how students and educators can better use the opportunities available at the Southeast's field stations.

129 • Stephen C. Richter

Educational and Research Opportunities in Appalachia and Across Kentucky Via a Network of Field Stations

Field stations provide outdoor classrooms and opportunities for placed-based experiential learning, research, and community outreach. Coordinated networks of field stations provide opportunities beyond the capacity of individual stations. In this presentation, I will discuss opportunities available at field stations using Eastern Kentucky University's three field stations, Lilley Cornett Woods, Maywoods, and Taylor Fork Ecological Area, as examples. Our Division of Natural Areas has supported scientific research, environmental monitoring, research-informed training, interdisciplinary collegiate education, K-12 environmental education, and community outreach for over four decades. I will also discuss a newly formed collaborative group of field stations in Kentucky, the Kentucky Organization of Field Stations (KOFS), opportunities afforded by this network, and

¹ Campbell University; ² Beacon College

suggestions for initiating an organization in other states. In 2009, colleagues and I surveyed postsecondary schools across the state to determine how many field stations existed (J Kentucky Acad Sci 71:95-102). Although we were only aware of a handful and only four were members of the Organization of Biological Field Stations, we discovered over 20 stations that were associated with community colleges to PhD granting institutions. This indicates that the number of field stations in other states might be greatly underestimated. Soonafter, we formed KOFS to support and promote understanding of natural systems through education, research, and outreach in Kentucky. We hope researchers and educators will take advantage of the field opportunities in Kentucky and work to establish new sites. Additionally, we hope other states will use this model to develop collaborative networks of field stations.

Dept of Biological Sciences and Division of Natural Areas, Eastern Kentucky University, Richmond, KY

130 · Karen L. Kandl

Highlands Biological Station: Nine Decades of Research and Education in a Biodiversity Hotspot

Highlands Biological Station (HBS) was founded in 1927 by a group of amateur and professional biologists and concerned citizens in the Highlands, North Carolina area. Since its inception, research at HBS has capitalized on the rich biodiversity of the region, which has attracted investigators working on many different groups of organisms and ecological systems. Many of the education and research opportunities at HBS focus on questions related to fundamental issues in conservation, ecology and evolution, including the effects of non-native invasive species, land use change, species loss as a driver of global environmental change, and the effects of climate change on biodiversity, species distributions and evolutionary processes. We offer summer academic field courses and workshops in various topics, highlighting the biodiversity of the southern Appalachians in the context of broad ecological and evolutionary questions. In the fall, HBS serves as a field site for the UNC-CH Institute for the Environment. During this semester-in-residence program, undergraduate students investigate environmental problems related to biodiversity and land preservation. Throughout the year, HBS hosts seminars and lectures focused on the tremendous biodiversity of the region. Our Foundation's Grants-In-Aid of Research program supports 10-15 visiting researchers each year. Investigators study diverse organisms, including salamanders, fungi, bryophytes, spiders, and invasive plants, and ask globally important questions, such as those involving climate change, land use, habitat restoration, and pollination biology. Highlands Biological Station is exceptional for its location, engaged community, and legacy of globally significant research and immersion instruction based in the southern Appalachians.

Highlands Biological Station

131 • Theron M. Terhune

Plugging-in to Research in the Red Hills: Research and Education at Tall Timbers Research Station

Tall Timbers Research Station and Land Conservancy's (hereafter, Tall Timbers) mission is to foster exemplary land stewardship through research, conservation and education. The Station's primary research focus is the ecology and management of fire-dependent ecosystems, and wildlife, including northern bobwhite quail. Conservation efforts are dedicated to helping protect the distinctive, rural landscape of South Georgia and North Florida and its traditional land uses. Tall Timbers is internationally regarded as an information resource in the areas of fire ecology, game bird management, vertebrate ecology and forestry. The Research Station is recognized as the home of the study of fire ecology and the Fire Ecology Conference Proceedings serving both an educational role and voice as an advocate to safeguard the right to use prescribed fire for land management. Long-term research is a hallmark of the Station and includes decadal (50+ years) work on fire plots and extensive mark-recapture of northern bobwhites and other species, including songbirds and gopher tortoises. The education

program transfers research and conservation information to the hands of the practitioners for improved resource management and landscape-level impact. In addition, a key focus in education is providing field experience and research exposure to young aspiring students and biologists. The types of education vary as widely and uniquely as our research programs and range from basic principles in GIS/GPS to Fire Ecology to Game Bird management to general natural resource and habitat manipulation. As such, students mentored at Tall Timbers leave well prepared for a wide-array of jobs in ecological research.

Tall Timbers Research Station and Land Conservancy, Tallahassee, FL

132 • Robin C. Buchannon

The University of Mississippi Field Station and Center for Water and Wetlands Resources: Educational Research Opportunities

The University of Mississippi (UM) Field Station is a research and educational facility designed to serve UM faculty, staff and students as well as visiting faculty and students, public and private schools, government agencies and the broader community of the Mid-South. The Field Station (UMFS) is located on 746 acres of diverse habitat 11 miles northeast of Oxford, MS, UMFS is an excellent resource for those who wish to do freshwater, wetlands and closed canopy research. We offer both natural and constructed wetlands in the form of 220 ponds, 6 natural springs, 4-capped artesian wells and numerous seeps that equal to approximately 90 acres of surface water. From the property's beginnings as a minnow farm in the 1940's to its inception as the UM Field Station, fresh water has played an important role in defining the use of this unique property. The unique educational opportunity we will focus on in our presentation is the abundant availability of fresh water on the Field Station property. This resource is directly connected to at least half of all research done at the site. We will present details of several ongoing projects and classes that directly pertain to this important resource. We will also discuss our outreach efforts and the ecology day camp for kids and how we use these opportunities to introduce the ideas of water conservation and good stewardship of natural resources.

The University of Mississippi, Oxford, MS

133 • Hilary M. Swain, Fred E. Lohrer, Dustin D. Angell

Archbold Biological Station: Sustaining the Confluence of Research, Conservation, and Education in Florida

Archbold Biological Station, in south central Florida, is dedicated to research, conservation, and education. We summarize trends in graduate, undergraduate, K-12, and public education at Archbold, and describe the intersection of education with research and conservation. Archbold, founded in 1941, hosted our first graduate student in 1957. Since the 1960s faculty have taught their college classes at Archbold, ranging from an introduction to Florida ecosystems to graduate ecology. Archbold's research internships commenced in 1968; they provide a residential 6-12 month research experience including independent ressearch. More than 400 interns, mostly postbaccalaureates, have been trained, and many have gone onto graduate studies. Early on, Archbold offered intermittent K-12 experiences, mostly middle and high school but in 1991 a formal 3-5th grade program and summer camps were initiated. Since then we have reached more than 40,000 students from surrounding rural schools and now serve ~50% Hispanic and African American children. We describe our K-12 programs, emphasizing linkages between research and curricula development. In 2012 Archbold expanded outreach programs, building a LEED Platinum Learning Center with self-guiding trails and activities for the public. Our educational opportunities have returned benefits. We illustrate how education has: (i) created a pipeline of future scientists returning to conduct research and teach classes: (ii) trained the conservation stewards who protect surrounding ecosystems: (iii) inspired the public to serve as volunteers; (iv) engaged donors and increased fundraising potential; and (v) fostered strong local support for Archbold and our important work in protecting species, habitats, and ecosystem services.

Archbold Biological Station, Venus, FL

134 • Matthew E. Kimball, Dennis M. Allen

Research and Education at the University of South Carolina's Baruch Marine Field Laboratory: Opportunities for Undergraduate Field-Based Experiences

The University of South Carolina's Baruch Marine Field Laboratory (BMFL) is located on a 17.500 acre tract of land comprised of coastal forest, freshwater wetlands, and salt marsh habitats, collectively called Hobcaw Barony, located in Georgetown, South Carolina. In operation for nearly 40 years, BMFL has an expansive presence at the marsh edge alongside the North Inlet estuary that includes a large laboratory complex with classrooms, running seawater facilities, and boat/shop infrastructure all tailored specifically for university-level research and teaching. Undergraduate students from both in-state and out-of-state colleges and universities come to BMFL and its environs during all seasons for course field trips (e.g., 26 such trips in 2013) or as part of undergraduate internship/volunteer research activities, particularly during summer (e.g., 12 students during 2013 summer), and gain valuable hands-on experience outside of the classroom. Further, in addition to the usual physical and natural science majors (e.g., geology, biology). BMFL hosts field trips geared towards a variety of other disciplines, such as art and history, that have incorporated coastal and estuarine themes into their courses. Because BMFL has ample and affordable on-site dormitory space, overnight stays for short (e.g., days) trips and entire courses (1 to 3 weeks) are possible. Regardless of discipline or background, these field-based, first-hand experiences serve to reinforce concepts discussed in the classroom, demonstrate scientific principles and techniques, and allow a greater understanding and appreciation of nature; ultimately (and hopefully) motivating undergraduate students and exciting their interests in the natural world for a lifetime.

Baruch Marine Field Laboratory, University of South Carolina, Georgetown, SC

135 • Tom B. Blanchard, Jennifer Greenwood, Dawn Wilkins, Lisa Krueger

The Changing Role of Reelfoot Lake Environmental Field Station in Providing Educational and Research Opportunities Along the Mississippi River Floodplain of Northwest Tennessee

Reelfoot Lake Environmental Field Station was established as a University of Tennessee at Martin (UTM) facility in 1981. Until 2010, the station was operated through the Dept of biological sciences and primarily served as housing and laboratory space for UTM course field trips. It also served as a base of operation for faculty conducting research in the Reelfoot Lake area. In 2007, funding from the U.S. Dept of Education was received to support activities related to K-12 education. It was felt however, that the station was not reaching its potential in supporting undergraduate education and scientific research. In 2010, administration of the station was transferred to the College of Engineering and Natural Sciences and a half-time director was appointed. Since 2010, a formal summer course program has been established and there are currently six courses being offered in the biological sciences and geology. The courses last 2-5 weeks and are designed to provide hands-on experiences in field techniques common to each area of study. Funding to support UTM undergraduate research in the Reelfoot Lake area is available through the Smith, Henson, Sliger Undergraduate Research Scholarship. The scholarship grants approximately \$4,000 per award and is intended to help students cover living expenses while conducting research during the summer. RLEFS is currently seeking NSF funding to facilitate the development of a strategic plan with the long-term goals of strengthening collaborations with other universities/agencies and expanding opportunities for undergraduate education and scientific research in the Reelfoot Lake area.

Dept of Biological Sciences, University of Tennessee at Martin, Martin, TN

139 • Clayton M. Costa, Roland P. Roberts

Molecular Phylogeny of the Goldenasters, Subtribe Chrysopsidinae (Asteraceae, Astereae), Based on Nuclear Ribosomal and Chloroplast Sequence Data

Subtribe Chrysopsidinae, also known as Goldenasters, is a group of wildflowers distributed from North to South America and inclusive of eight genera sensu Semple. Historically, phylogenetic inference of the Chrysopsidinae has been based on morphological criteria, resulting in the proposition of multiple classifications by different researchers. Some studies based on chloroplast DNA restriction site data have been inconclusive in the resolution of relationships among all the genera and species in this group. Furthermore, no single study has sampled among all genera or all known species of the Chrysopsidinae for assessment of evolutionary relationships. In this study, we estimated phylogenies based on molecular data from ETS and ITS, nuclear ribosomal DNA, and ycf1 and psbA-trnH, chloroplast DNA for all known genera of the Chrysopsidinae. We used these phylogenies as the basis for addressing questions related to subtribal and generic monophyly, the relationship of Central and South American genera, Osbertia, Tomentaurum, and Noticastrum to North American genera, morphological trait evolution and the frequency of convergence among morphological features commonly used to delimit species boundaries. Results from analysis of independent and combined data support the monophyly of the Chrysopsidinae. We observe generic resolution among members of the Chrysopsidinae, and some sectional resolution within the genus Heterotheca. However, like for other groups of tribe Astereae, the search continues for genetic markers that are variable enough to resolve relationships among species.

Towson University

140 • Timothy A. Hammer¹, Robert W. Davis², Kevin R. Thiele²

A Molecular Framework Phylogeny for Ptilotus R.Br. (Amaranthaceae)

Ptilotus R.Br. (Amaranthaceae) comprises over 100 species, which are endemic to Australia except for one species (P. conicus R.Br.) that has a distribution extending to Timor and adjacent islands. The center of diversity for the genus is the arid Eremean Province of Western Australia, with smaller numbers of species found in open mesic temperate areas and wet-dry tropics. Family-wide studies have placed Ptilotus within the monophyletic Aervoid clade, consisting of Aerva Forssk. (16 spp.), Nothosaerva brachiata L. and Ptilotus. A lack of extensive sampling within this clade has made it difficult to discern the relationships between the genera. To date, no robust infrageneric classification has been proposed for Ptilotus, in part due to the lack of consistent morphological differences between the major groups of taxa. ITS nrDNA and matK cpDNA were amplified by PCR and sequenced from all major informally recognized groups within Ptilotus and several outgroup taxa. Sequences were edited with Geneious 6.0, aligned using webPRANK, and analyzed using maximum parsimony, maximum likelihood and Bayesian inference. The current study provides the first framework phylogeny for Ptilotus, provides evidence for the monophyly of the genus, clarifies phylogenetic relationships within the genus and the Aervoids, allows assessment of congruence of robust clades with morphological variation, and identifies characters to aid in an infrageneric classification. This study will provide the framework for future studies into character evolution, physiology and ecology in the genus; in addition, Ptilotus is likely to provide useful insights into the evolution and adaptation of the arid Australian biota.

Dept of Biological Sciences, Old Dominion University, Norfolk, VA; Western Australian Herbarium, Dept of Parks and Wildlife, WA, Australia

141 • Kunsiri Chaw Grubbs1, Hugo Volkaert2

A Possible Hybrid Origin for Edible Lansium domesticum

Edible Lansium domesticum, Meliaceae originated in Malaysia. It grows wild and has been cultivated in many places around Southeast Asia. Little has been studied about the origin of this type of L. domesticum. The morphological traits and genetic diversity were examined from major sites in Thailand. The results indicate that the overall features of this type of L. domesticum were almost identical except for a few fruit characteristics. The single strand conformational polymorphism (SSCP) technique was used to analyze the

relationship among varieties of *L. domesticum*. Three specific primers of glyceraldehyde 3 phosphate dehydrogenase (G3PDH), abscissic acid insensitive3 (ABI3), and isocitrate dehydrogenase (IDH) show high polymorphism. The results also indicate that edible *L. domesticum* varieties are heterozygous and triploid. The chloroplast molecular markers show that most edible *L. domesticum* varieties share the same maternal plant. The paternal side of this group has not yet been established. Future studies can examine more levels of genetic diversity by collecting more plant samples from similar or closely related species around the Indo-Malaysian Peninsula.

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142 • Bruce A. Sorrie¹, Robert K. Peet²

Floristics of East Gulf Coastal Plain Pitcher Plant Bogs

Pitcher plant bogs form one of the most distinctive plant communities of the East Gulf Coastal Plain (EGCP). These seepage communities occupy shallow slopes, interfluvial flats, and headwaters ecotones. We recorded all taxa in 74 bogs in Alabama, Florida, and Mississippi, All bogs sampled occurred within a matrix of natural longleaf and/or slash pine communities, had an undisturbed herbaceous layer, and had been subject to recurring prescribed burns. We documented 318 taxa in 137 genera and 65 families. Forty-four taxa are woody shrubs, trees, and vines, 247 are herbaceous plants, of which 9 are ferns and clubmosses and 18 are carnivorous plants. The most speciose families are: Asteraceae -43, Poaceae - 40, Cyperaceae - 37, Xyridaceae - 15, Orchidaceae - 14. The most speciose genera are Rhynchospora - 22, Xyris - 15, Dichanthelium - 10, Sarracenia - 7, and Andropogon - 7. Conspicuous in their absence were the Fabaceae with only one species and aliens which were entirely absent. Seventeen taxa are endemic to the EGCP, plus nine are near-endemics. Individual bogs supported 65-137 taxa, Taxon frequency ranged from 1-72 bogs; the top ten most frequent taxa ranged from 69-72 bogs. Analysis of the data suggest that pitcher plant bogs of the EGCP are composed of three types of vascular plants: 1) wetland generalists, 2) seepage bog specialists, and 3) EGCP endemics. We sought natural grouping of sites by numerical clustering and found that 4 to 8 groups appeared as distinct clusters that might be recognized as natural communities.

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143 • David L. Cutherell

Restoring the Northern Longleaf Pine Ecosystem: South Quay Sandhills Natural Area Preserve

The longleaf pine ecosystem reaches its northern limit in southeast Virginia, where it is represented by only a few surviving sites. One of these is South Quay, which has some of the oldest longleaf pines in the state and has been the main seed source for restoration efforts in Virginia. An initial plant inventory at this newly preserved site has found many species endemic to the sandhills region but rare or absent elsewhere in Virginia, such as Stipulicida setacea, Cuthbertia graminea, Vaccinium crassifolium, and Zenobia pulverulenta. The preserve also includes swamp forest along the Blackwater River and heath barrens that support a large diversity of ericaceous shrubs. A complete survey is in progress to document the flora of this key remnant of the northern longleaf ecosystem.

Dept of Biological Sciences, Old Dominion University, Norfolk, VA

144 • Richard A. Matthews¹, Lytton J. Musselman², W.C. Taylor, Peter W. Schafran² Isoetes snowii, a New Diploid Quillwort From the Southeastern United States

Rock outcrops of the southeastern United States have several endemic species of lsoetes. Here we describe a new diploid (2n = 22) from the coastal plain region of Georgia. The species is named lsoetes snowii in honor of Frankie Snow, the curator of the Broxton Rocks Nature Preserve, where it is found.

¹ Bainbridge State College, Early County Center, Blakely, GA; ² Dept of Biological Sciences, Old Dominion University, Norfolk, VA

145 • John M. Herr, Jr., James T. Morris

The Anatomy of the Rhizome of Spartina alterniflora: Fossil and Extant Specimens

Cross sections of rhizomes from extant *Spartina alterniflora* from Georgetown, SC and fossil specimens from Plum Island, MA were made initially with a hydro-microtome. The traditional paraffin embedding technique and rotary microtome were used later to produce better sections of the fossil specimens, since they required immediate fixation (ethanol: glacial acetic acid, 3:1) after they were collected from sediment at a depth of 100 cm. Structurally, the extant rhizomes and 500 year old fossil specimens are markedly similar. Both rhizomes have a large pith cavity and a ring of cortical air spaces each initially separated from adjacent spaces by a partition 2-3 cell layers thick that with determinate diametric growth of the rhizome stretch and become thin. In rhizomes of the largest diameter, some of the partitions are reduced to cell remnants. Two series of collateral bundles occupy the solid cortex between the pith cavity and the cortical air spaces. In fossil rhizomes, lignin is sufficiently altered so only rarely to provide a positive test with phloroglucin. The active phloem is not preserved in fossil rhizomes. Yet, nuclei, often without nucleoli, are preserved in most of the parenchymatous tissues.

Dept of Biological Sciences, University of South Carolina, Columbia, SC

146 · Ashley B. Morris

It Takes a Village: Building a Network of Primarily Undergradute Institutions to Address Large-Scale Phylogeographic Problems

Phylogeography as a field has surpassed the quarter-century mark, but many challenges remain. Studies involving geographically widespread species often suffer from a lack of sampling resolution, molecular resolution, or both. It will truly take a village to adequately address phylogeographic hypotheses under such scenarios. Here, I propose the development of a network of primarily undergraduate institutions (PUIs) to achieve this goal. PUIs offer a unique opportunity to integrate undergraduate research training, education, and collaborative research on a large geographic scale. Consider a species such as American beech, which is distributed from Nova Scotia to Mexico. An extensive network of PUIs would allow each institution involved to sample intensively on a local scale, genotype or sequence all invidividuals sampled in-house, and contribute to a much larger collective data set for further analysis. Resulting publications become a true, collaborative effort, with students learning the real process of science by doing the real process of science. Not only will education benefit, but science will also benefit from the improved sampling of such large projects. Furthermore, multiple sympatric species can be easily sampled and processed simultaneously, because each institution will have relatively limited responsibility within the context of the broader project. Such an ambitious project calls for careful planning and consideration of best practices for research design and project dissemination, the framework for which will be discussed in this talk.

Dept of Biology, Middle Tennessee State University, Murfreesboro, TN

147 • Kevin S. Burgess¹, John A. Barone², Robert B. Futrell³

DNA Barcoding a Complex Prairie Flora Using the rbcL-matK Gene Regions

Used in conjunction, the *rbcL+matK* gene regions have yielded relatively high species discrimination at a relatively low cost in previous studies. Here, we examined the effectiveness of these barcodes to distinguish species in a complex prairie flora that includes a high proportion of polytypic genera. 475 samples representing 204 species from 108 genera in 31 families were collected from the Black Belt prairie region of Alabama and Mississippi. Following high-throughput sequencing at the Canadian Centre for DNA Barcoding, contiguous sequences were downloaded from BOLD Systems for all-to-all BLASTn analyses. Although sequencing success was relatively high for *rbcL* (91%) and *matK* (68.2%), complete coverage for both regions was marginal (62.9%). Species

resolution was relatively low for *rbcL* (44.0%) and *matK* (43.1%) but increased for the combined barcode (51.0%). Monotypic genera were 2.8 times more likely to be successfully distinguished than polytypic taxa (mean species resolution was 88.9% for monotypic taxa and 35.7% for polytypic taxa). Furthermore, there was a significant, negative correlation between the number of species per genera and percent species resolution. The results suggest that for floras with a high number of closely related species, additional gene regions will be required to supplement the *rbcL+matK* barcode.

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148 • Peter W. Schafran¹, W. Carl Taylor², Rebecca D. Bray¹, Jay F. Bolin³, Lytton J. Musselman¹

Systematics of the Genus Isoetes (Isoetaceae, Lycophyta) in the Southeastern United States

Quillworts (Isoetes spp., Isoetaceae, Lycophyta) have been studied in the southeastern U.S. for nearly two centuries, yet their taxonomy and systematics are still poorly understood. Currently, twenty-five taxa are described in the region - twelve diploids, eight tetraploids, three hexaploids, one octoploid, and one decaploid. In addition to these there are three described hybrids, one diploid and two triploids. We have identified several undescribed diploids and tetraploids. Morphological characteristics are of limited taxonomic value, so specimens are often misidentified and taxa unnecessarily lumped or split. Molecular techniques have aided in unraveling this case of reticulate evolution, illuminating relationships between species and parentage scenarios of the numerous polyploids. Some allopolyploid species are polyphyletic with parentage varying by population. We expect to discover more with additional field work. We present a review of Isoetes in the Southeast based on current molecular, cytological and morphological evidence, focusing on the basic diploids, hybridization events, and the role of reticulate evolution in the group.

Dept of Biological Sciences, Old Dominion University, Norfolk, VA; ² National Museum of Natural History, Smithsonian Institute, Washington, D.C.; ³ Dept of Biology, Catawba College, Salisbury, NC

149 • Brianna L. Taylor, Naomi Jackson, Benjamin J. Thornton

The Effects of Ascorbic Acid on *Drosophila melanogaster* Susceptibility to Permethrin and Suppression of Cytochrome P450 Activity

Permethrin. 3-Phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl)-2,2dimethylcyclopropanecarboxylate, is a widely used pesticide in the United States as well as other countries around the world. Because of the pervasive use many non-target species are exposed resulting in challenges to individuals and possibly populations. An organism's defense against toxins in general, including permethrin, is via detoxification by ubiquitous enzyme systems, such as cytochrome P450s. Their role in the detoxification process is to oxidize xenobiotics, thereby increasing solubility in water and promoting excretion (Zhu et al. 2008). A number of studies have shown that dietary vitamin supplementation can enhance detoxification (Brodfuehrer & Zannoni 1986; Zannoni et al. 1982). The current study tested the susceptibility of Drosophila melanogaster to permethrin subsequent to exposure to various concentrations of ascorbic acid. Percent survivorship was determined revealing a sex-dependent response. Ascorbic acid supplementation had no observable effect on female susceptibility to permethrin. Males exposed to 15% ascorbic acid exhibited a significant increase in survivorship compared to controls. Lang and Liu (2013) showed that elevated P450 gene expression enhanced resistance to Permethrin in Culex auinquefasciatus. In this investigation, males exposed to 15% and 20% ascorbic acid showed an unexpected significant decrease in cytochrome P450 enzyme activity compared to the control. Females showed a similar change in P450 ASB Paper Abstracts 309

activity in the 20% exposure only. These documented changes in P450 activity do not explain the observed increased resistance to Permethrin in male *D. melanogaster*.

Biology and Allied Health, Southern Adventist University, Collegedale, TN

150 • Jemirian Pitts

A Mathematical Model for Glucose-Oxygen Kinectics and Cell-Mediated Response in Prostate Cancer Cells of Type II Diabetes

Mathematical models offer a foundation to gain valuable insight in the development and growth of tumor-immune dynamics. I present a new mathematical model that will describe prostate tumor growth in Type II diabetic patients. Additionally, I will offer a mathematical model that will describe immune response, focusing on the role of T-lymphocytes. Finally, I will propose a model that will describe tumor-immune interactions. Each model uses a system of differential equations. Growth rates are determined, under intrinsic Glucose-Oxygen environments. Parameter estimates and mathematical model validations employ published human studies. The model will attempt to provide an adequate first step toward the understanding of cancer dynamics influenced by type II diabetes.

Dept of Biology, Dept of Mathematics, Columbus State University, Columbus, GA

151 • Linda A. Major, Roger A. Sauterer

Histone Binding to Mitochondria in Plants

The genome is continuously exposed to DNA damaging agents that activate the DNA damage response to either repair the DNA or induce apoptosis. During the early DNA damage response, the chromatin compaction around damaged sites is relaxed through specific core histone modifications and displacement of the linker histone H1. In mammalian cells, studies suggest that displaced histones enter the cytoplasm and bind to mitochondria, leading to the permeabilization of the inner and outer mitochondria membranes. This event triggers the release of pro-apoptotic proteins, including cytochrome C, from the mitochondrial intermembrane space to the cytosol where they activate caspases and endonucleases that initiates apoptosis. We investigated whether this mechanism occurs in plants as well. Our preliminary results indicate that histone proteins bind to mitochondria and induce mitochondrial membrane permeabilization in plants. We isolated mitochondria and histone fractions from store-bought cauliflower; then a histone-enriched fraction was added to a mitochondria-enriched fraction, incubated, and examined by Western Blotting against histone H3 and cytochrome C. The results show H3 histones in the mitochondrial pellet but not in the supernatant of the experimental sample, cytochrome C in the pellets of the control and experimental sample, and cytochrome C in the supernatant of the expermental sample but not in the control. The results of this study suggest that histone proteins bind to mitochondria affecting the release of cytochrome C from the intermembrane space of the mitochondria and suggest that the interactions between mitochondria and histones may be broadly conserved across eukaryotes.

Biology Dept, Jacksonville State University, Jacksonville, AL

152 • Roger A. Sauterer, Linda A. Major

Plant Cell Nuclear, Mitochondrial and Chloroplast Isolation: Procedures and Pitfalls

Organelle purification from plant cells is much more challenging than from animal cells due to the presence of cell walls, vacuoles and often relatively low organelle concentrations and each plant tissue is different. We describe suggested procedures for fractionating fairly clean mitochondria, chloroplasts and nuclei from plant cells. Plant tissue can be treated with Viscozyme to obtain protoplasts, but yields are low and intact cells contaminate the samples. Grinding soft leaves in a blender or with a mortar and pestle works best. Tissues with small cells or thick cell walls require empirically determined blending speeds and time. Differential centrifugation followed by Percoll step gradient centrifugation works best to fractionate organelles. Fairly pure chloroplasts are easily obtained by Percoll gradient centrifugation from soft leaves such as spinach. Nuclei are best obtained using chloroplast-free tissues such as cauliflower, as chloroplasts

contaminate nuclei fractions on Percoll gradients. Triton differential lysis procedures result in contamination of nuclei by chloroplasts and other organelles. Mitochondria are best obtained by low-speed centrifugation to remove cells, nuclei and large organelles, followed by high-speed centrifugation of the supernatant and Percoll gradient centrifugation of the pellet. In all cases, the exact Percoll concentration for each layer may differ substantially from published procedures depending on tissue type used, age of tissue, and plant species and must be determined empirically. Both plant material amount and the volume of each Percoll gradient step is critical to get sharp bands at the gradient interfaces rather than diffuse bands in a given Percoll layer.

Dept of Biology, Jacksonville State University, Jacksonville, Alabama

153 • Daniel W. Konzman, Linda Niedziela

The Effect of Pentylenetetrazol-Induced Seizure and the Anti-Epileptic Drug Phenytoin on Learning in *Danio rerio*

Impairments of cognitive function can be caused by both epileptic seizures and antiepileptic drugs, complicating the management of epileptic disorders. The present study investigated the cognitive impairments due to seizures to those caused by the antiepileptic drug phenytoin. Adult zebrafish (Danio rerio) will be used as the model system. as they have been shown to be reliable model systems for epilepsy as well as simple learning and conditioning. Learning through operant conditioning in a T-maze was used to measure cognitive impairment. Seizures will be kindled using pentlyenetetrazol (PTZ), a compound that has been established for its utility in seizure research in adult zebrafish. Three chemical treatment groups were tested to compare the effects of seizure with those of the phenytoin and their interaction: PTZ alone, phenytoin alone, PTZ with phenytoin pretreatment, and an untreated control. Each fish was conditioned over 16 trials in a Tmaze using positive punishment. Learning was assessed primarily by the number of trials it took each fish to reach a total of three correct responses. Results showed learning speed was significantly (p<0.01) reduced for the PTZ only condition and the doublytreated condition as compared to control. A trend toward increased impairment was seen when fish received the combination treatment compared to the PTZ only group. These results indicate that phenytoin does not ameliorate the cognitive impairment associated with seizures, as was expected based on similar studies using different anti-epileptic compounds. The observed effect poses a potential problem for those managing their epilepsy with phenytoin and warrants further investigation.

Elon University

154 • Colleen K. Mikelson, Manuel Bernal Mejia, Margaret J. Kovach

A Feasibility Study of Utilizing a Biocompatible Nanofiber Matrix for Bone Regeneration

The need for effective treatment of traumatic bone defects has increased in both military and domestic settings. A possible solution has been to utilize nanofibers as a scaffold for the purpose of facilitating regeneration of bone. This study seeks to develop a designer nanofiber-based bone repair device that is capable of delivering drugs while facilitating regeneration of the bone. Towards this goal, we evaluated a panel of nanofiber compositions consisting of poly(lactic-co-glycolic acid)(PLGA), hydroxyapatite (HA), collagen and antibiotics for in vitro cytotoxicity, cellular proliferation, migration and osteoblast differentiation. All assays were carried out using the human embryonic palatal mesenchyme (HEPM) stem cell line under conditions of glucocorticoid differentiation. Cell viability was measured as a function of metabolic ATP production. Confocal and light microscopy was used to evaluate cellular adherence and migration on nanofiber matrices. Finally, as a positive indicator of osteoblast differentiation, osteocalcin (OCN) gene expression was evaluated via RT-PCR. All nanofiber compositions tested support active proliferation. Cell viability, reported as a percent of the non-nanofiber control, ranged from 36-89%. With the exception of nanofibers containing the antibiotic tobramycin, relative proliferation levels were similar among all nanofibers, indicating that differences in chemical additions to the PGLA nanofibers were not likely to be the sole reason for the reduced proliferation of cells on nanofibers. Confocal microscopy revealed migration of adherent cells throughout the nanofiber matrix and these cells were positive for osteoblast differentiation. Future directions include a pilot study for nanofiber safety and efficacy in a rabbit model for bone repair.

Biological and Environmental Sciences, University of Tennessee at Chattanooga, Chattanooga, TN.

155 • Molly R. Shankles¹, Robert Grammer

Integrating Chemotaxis and Thermotaxis in Caenorhabditis elegans

In wild-type Caenorhabditis elegans an attraction has been shown toward the thermal temperature that the worms were cultivated, as well as a wide variety of chemical attractants including almond extract. By presenting the worms with two simultaneous stimulants, chemical and thermal, which are detected by separate neurons, the synapses and pathways that the worms use to make a choice regarding a stimulus can be examined. We have found that the worms are strongly attracted crylophilically to their cultivation temperature, if it can be found on the plate, and are otherwise strongly attracted to the chemical attractant (almond extract). Interestingly, the worms were unable to move both thermophilically (up the temperature gradient) and toward the almond extract (chemical attractant used). This is interesting because it points to the importance of the AWC neuron and also the ability of one sensation to override the other.

156 • Cristina M. Caldwell¹, Michele Elmore², Julie Ballenger³, Kevin S. Burgess³

Examining the Genetic Structure in a Hybrid Zone of Rare Georgia Pitcher Plants (Sarracenia Spp.)

Hybridization has been shown to have negative impacts on rare plant populations. Specifically, asymmetrical introgression can lead to the loss of rare parental taxa via genetic assimilation into the genomes of more abundant congeners. Less is known, however, about the occurrence of introgression between parental taxa that do not differ in abundance. Pitcher plants belonging to the genus *Sarracenia* are insectivorous plants endemic to North America. Eight of the nine species within the genus are concentrated in the southeastern United States, where they are threatened primarily by habitat degradation. Here, we investigate the potential occurrence of introgressive hybridization in sympatric populations of *Sarracenia rubra* (sweet pitcher plant) and *Sarracenia psittacina* (parrot pitcher plant), two species that are listed as threatened within the state of Georgia. Currently we are using DNA barcode markers to confirm the genetic identity of parental taxa as well as determine the parentage of putative hybrids. Furthermore, microsatellite analyses will be used to establish hybrid indices that will provide novel insight into the process of introgressive hybridization occurring between these two rare species.

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157 • Matthew A. Heard, Robert Grammer

Innate Versus Learned Response to *Bacillus thuringiensis* and Isoamyl Alcohol as Modeled by Olfactory Chemotaxis Response in *Caenorhabditis elegans*

Caenorhabditis elegans has been shown to exhibit innate positive chemotactic responses to chemicals as well as bacterial attractants. C. elegans can be classically conditioned with the coupling of starvation in the presence of the odorant and known attractant isoamyl alcohol. The nematode learns to associate the isoamyl alcohol with starvation and deviates away from the chemical. C. elegans normally shows an innate, positive response to Bacillus thuringiensis. Through this method, the strength of innate and learned responses can be compared. In the presence of isoamyl alcohol and Bacillus thuringiensis, a positive or negative response to the mixture on the plate will reveal which stimulus induces a stronger chemotactic response. It was hypothesized that the

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nematodes will show a higher response to the isoamyl alcohol because it will have just been conditioned to show a negative response to one of the attractants.

158 • Alex Panuccio, Renee J. Chosed

Modeling the Mixed-Lineage Leukemia (MLL1) Multi-Protein Complex in Budding Yeast Saccharomyces cerevisiae

The chromosomal rearrangements that can occur within the MLL (mixed lineage leukemia) gene are associated with a variety of leukemias. Though the molecular mechanisms behind the oncogenic activity of MLL chimeric proteins remains obscure, it is known that several MLL complexes exist in humans, including MLL1. The MLL1 methyltransferase enzyme is part of a multi-protein complex that via methylation of histone H3, specifically at lysine 4, regulates gene expression. It is also known that this complex has a homolog in Saccharomyces cerevisiae, the COMPASS complex. We replaced specific proteins in the yeast COMPASS complex with their human counterparts (RbBP5, WDR5, and MLL) to further elucidate their roles in the regulation of the enzymatic activity of the MLL1 complex. We then assayed for the activity of the protein complex by detecting histone H3K4 methylation by Western blotting. Deletion of the SWD3 gene and the SWD1 gene of the COMPASS complex led to the elimination of H3K4me3 in yeast. The human homologues of each gene were then transformed into the deletion yeast strains, but a full rescue of the phenotypes was not observed. This research may lead to a better understanding of the human MLL protein complex and its role in cell regulation and cancer.

Dept of Biology, Furman University, Greenville, SC

159 • Brian S. Burnes

Sources of Escherichia coli In the West Fork of the Salmon River, Idaho

The Middle Fork of the Salmon River, Idaho flows 110 miles through the Salmon River Mountains in the midst of the 2.367 million acre (9,580 km²) Frank Church--River of No Return Wilderness Area. The area is one of the least developed in North America, thus the river and surrounding watershed are nearly pristine. This setting was chosen to investigate the contribution of *E. coli* from native warm-bodied animals to natural riverine systems. In this study, 104 *E. coli* isolates from sites along the Middle Fork were analyzed by antibiotic resistance analysis to investigate their population structure and possible sources of origin. The correct classification rate was 77.9% for isolates from deer, horse, an unknown carnivore, and a laboratory reference strain 25922. Of the isolates collected from the Middle Fork, 82.1% matched none of the animals tested and represent another source of origin.

Dept of Biological and Environmental Sciences, University of West Alabama, Livingston, AL

160 • Brian S. Burnes

Sources of Escherichia coli In Lake Martin, Alabama

Lake Martin, Alabama is a 44,000-acre (178 km²) hydroelectric reservoir built in 1926. The lake has become highly developed in areas and in summer months is frequented by thousands of recreational boaters and swimmers. Additionally, wild geese nest on the lake, often in proximity to swimming areas. Occasional high *E. coli* counts from Lake Martin waters have raised the question of whether geese or humans may be responsible, in some part, for the bacterial contamination. In this study, 76 *E. coli* isolates from various sites in Lake Martin were analyzed by antibiotic resistance analysis to investigate their population structure and possible sources of origin. The correct classification rate was 97.2% for isolates from humans, geese, and a laboratory reference strain 25922. Of the isolates collected from sites in Lake Martin, 82.5% were classified as human in origin.

Dept of Biological and Environmental Sciences, University of West Alabama, Livingston, AL

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161 • Andrew J. Jajack, Andrew E. Rosselot, Blake W. Nelson, Jay A. Yoder

Pathogenic Consequences to Honey Bee Colonies From Reducing the Abundance of Beneficial Fungi by Fungicide Spraying

Fungicides used for treating agricultural and orchard crops minimize the amount of naturally occurring spores in the environment. Honey bee (Apis mellifera) colonies rely on certain beneficial fungi, Aspergillus, Penicillium, Cladosporium, Rhizopus, to generate a natural defense shield for protection against microbial diseases and to make bee bread, stored fermented pollen, a source of food for proper development of bee larvae. During foraging, fungicide residues are brought into the colony via contaminated pollen. To explore the relationship between fungicide spraying and bee diseases, bee bread samples from seven habitats were analyzed for fungicide residues and fungus composition combined with a bee disease diagnosis. A 70% overall reduction in fungal components, targeting different fungi, was noticed in bee bread from funcicide-sprayed habitats versus control bee bread from unsprayed regions that had no detectable fungicides. Surprisingly, samples from a certified organic orchard displayed the greatest fungicide contamination and reduction in colony-associated fungi. Bee colonies having fungicide contamination had chalkbrood symptoms, a lethal mummification disease of bee larvae. We concluded that fungicide contamination can occur for any bee colony within 3.5km (bee flight range) of a sprayed area; different fungicides impact composition of bee colony-associated fungi differently, thus moving bee colonies has particular detrimental effects; and chalkbrood is a sign of an immuno-compromised colony that has elevated risk of colony collapse disorder.

Dept of Biology, Wittenberg University, Springfield, OH

162 • Haiwen Zhang

Selection for Triclosan Resistance Causes Antibiotic Resistance in *Pseudomonas* aeruginosa but Not *Escherichia coli*

Triclosan is a widely used antimicrobial, found in hand sanitizer, soap, and many personal hygiene products include body deodorants, but studies by Cottell et.al (2009) and Braoudaki and Hilton (2004) have pointed out that triclosan tolerant bacteria may develop cross resistance to other antibiotics. Thus, the over usage of triclosan could select for antibiotic resistant bacteria. The cross-resistance hypothesis is being retested in this study. By exposing wild-type bacteria to five rounds of selection, I created five populations of triclosan-resistant Eschericia coli and five populations of triclosan-resistant Pseudomonas aeruginosa. Simultaneously, I established five unselected populations of each of the two species as a control. I then exposed both selected and unselected populations to 1) 10µL 0.45% triclosan, 2) 5mcg ciprofloxacin, and 3) 10mcg streptomycin and measured resistance to each. Although E. coli acquired increased triclosan resistance after selection, it did not develop cross-resistance to either of the two antibiotics. P. aeruginosa developed resistance to ciprofloxacin after selection for triclosan resistance, but did not show increased resistance to streptomycin. Interestingly, P.aeruginosa strains displayed decreased resistance to triclosan after selection, a result that was confirmed in a replicate study.

Biology Dept, Wofford College, Spartanburg, SC

163 • Mai H. Tran, Joong-Wook Park

Tarballs on Freshwater Shoreline as Reservoirs for Pathogens

Tarballs are remnants of petroleum found on the shoreline after an oil spill or oil seep. They are considered a contaminant to the environment and much research has focused on the potential of the hydrocarbonoclastic microbes present in them. The study by Tao et al. in 2010 was the first to reveal that marine tarballs could pose a hazard to human health because they could act as reservoirs for pathogens. In their research, tarball samples collected on the Gulf of Mexico beaches were found to contain *Vibrio vulnificus* at ten to a hundred times higher than the amount normally observed in marine environments. This study proposes to investigate tarballs collected on the shoreline of Lake Pontchartrain,

Louisiana, to validate the hypothesis that pathogenic bacteria also accumulate in freshwater or brackish water tarballs. DNA extracted from the bacterial samples will be analyzed using PCR-DGGE and BLAST techniques to identify the microbial groups present.

Dept of Biological and Environmental Sciences, Troy University, Troy, AL.

164 • Amanda N. Hyre, Philip Rock

Wolbachia Infection in a Local Strain of the Common Fruitfly Drosophila melanogaster

Wolbachia are obligate, intracellular prokaryotic endosymbionts present in a wide variety of arthropod hosts. It is estimated that from 20-70 per cent of insect species harbor this organism. The endosymbiont is maternally inherited. In some species, certain strains of Wolbachia are known to affect reproduction in a number of different ways, including: feminization of males, male killing, or reproductive isolation due to cytoplasmic incompatibility between infected and uninfected insects. A locally obtained strain of fruitfly is shown to be infected with Wolbachia, as detected by a polymerase chain reaction (PCR) amplification of the gene for a conserved Wolbachia surface protein (wsp). This strain has been cured' of the endosymbiont by treatment with the antibiotic tetracycline. Here it is demonstrated that cultures derived from Wolbachia-infected females produce significantly fewer progeny than cultures from uninfected females. The maternal inheritance of Wolbachia in the local strain is supported by PCR analysis of crosses involving pair-wise combinations of infected and uninfected fly strains.

Biology Dept, Virginia Wesleyan College, Norfolk, VA.

165 • Annette M. Golonka, Bettie Obi Johnson, Jonathan Freeman, Daniel W. Hinson Impact of Nectarivorous Yeasts on Silene caroliniana's Scent

Silene caroliniana is considered a scentless flower, but is insect-pollinated and produces a nectar reward. This plant is host to nectar-associated Metschnikowia yeast species. In this study, the scent profile of S. caroliniana is determined, and the contribution of nectar inhabiting yeasts to its scent is evaluated using solid phase micro-extraction and gas chromatography-mass spectrometry (SPME-GC-MS). The scent compounds produced by nectar isolated Metschnikowia species are identified and their impact on the flowers's scent is determined. Analyses of the scent profiles of unvisited nectar, unvisited flowers, and visited nectar confirm that this plant produces few scented compounds unless microbial organisms are present in the nectar. Metschnikowia species contribute aliphatic alcohols, including ethanol, 2-methyl-1-propanol, 3-methyl-1-butanol, and2-methyl-1-butanol to S, caroliniana's scent.

Math,, Science, Nursing, and Public Health, University of South Carolina Lancaster, Lancaster, SC

166 • Henry G. Spratt, Jr., Martin M. Brown, Erin Liner, William C. Hayes

Development of Sporulating Bacterial Cultures for Incorporation Into Pervious Concrete Before Curing

Observations of pervious concrete in place for more than 10 years often indicate substantial clogging. A pervious study of soil bacteria that might potentially clog this concrete produced three cultures (sporulating, Gram + rods, capsule +) that reduced flow by at most 40%, and in several cases by only 2 to 3%. In this study these cultures were grown in tryptic soy broth (TSB) for five days, and added to pervious concrete mix. Control (sterile saline added) test cores were poured first, followed by the three separate sets of spore-added test cores, all in mid July 2013. After curing, the cores were moved into a storage area in the microbiology lab. They were covered and maintained under ambient conditions (temperature range 19 to 22 °C). The cores were left for approximately six months before control and experimental cores were sampled using an alcohol flamed chisel to cut approximately 2 cm from the outside of the cores at two depths. Then, using flamed forceps, chips from inside the cores were removed and placed in either sterile TSB or onto the surface of TSA plates. These were incubated at room temperature for 72

hours. No growth was observed for any sample from control cores. Growth resembling the culture added to the mix was observed on the TSA plate for samples from an experimental core. Quantification of spore survival in this concrete is ongoing. Potential uses for spore impregnated pervious concrete could include the bioremediation of hydrocarbon wastes typically found on concrete surfaces.

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167 • Crystal N. LeBlanc, Jennifer T. Thomas

The Evaluation of Type I Interferon Levels in HPV-Positive Cervical Cancer Cell Lines

Human Papillomavirus (HPV) is the most common sexually transmitted virus in the United States and the leading cause of anogenital and oropharyngeal cancers. Previously, it has been determined that levels of IRF-3, a transcription factor allowing for expression of antiviral type I interferons, are reduced in HPV-positive cervical cancer cell lines. As an extension of this work, we wanted to determine if type I interferon levels themselves are also reduced in the presence of HPV by Western Blot analysis. We confirmed decreased levels of IRF-3 in HeLa cells versus C33A cells. Original analysis of cell lysates revealed faint expression of Interferon-a and Interferon-b for both cell lines, however, the levels were too low to distinguish between the samples. Given that Interferon-a and Interferon-b are secreted proteins and their levels of expression in cell lysates were low, we next examined supernatants for Type I interferons. Analysis of supernatants Indicate possible dimer formation of the Type I interferons in C33A and HeLa cells. Future studies can compare levels of the secreted interferons between C33A and HeLa cells. Taken together, these results may indicate that HPV can suppress antiviral activity downstream of IRF-3 and potentially contribute to immune evasion and cancer progression.

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168 • Grace L. Chafin¹, James W. Brown², Melanie J. Lee-Brown¹

Mutagenesis of the FMN Riboswitch of Photorhabdus Luminescens and an Analysis of Mutagenic Effects on Its Pathogenicity on Caenorhabditis Elegans

Riboswitches are an important aspect of the regulation of some genes in bacteria. The binding of effector molecules to mRNA leader regions specifies their secondary structures, which modulates transcription termination and therefore the expression of downstream genes. This study examines the FMN riboswitch located upstream of the rib operon in Photorahbdus luminescens, and seeks to determine if this region of regulatory RNA is a potential target for novel antimicrobials. The pathogenicity of this bacterium on its host, Caenorhabditis elegans, will be examined via mutagenesis to lock the riboswitch in the on or off conformations using the lambda-Red recombineering system. If the bacterium loses virulence when the FMN riboswitch is locked in the off confirmation, it may mean that the bacteria cannot bypass the rib pathway and can therefore not sequester FMN from its host. This finding would focus attention on the FMN riboswitch as a potential target for novel antimicrobials for use against multi-drug resistant bacteria.

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169 • Jake H. Billmyer, Frank S. Gilliam

Effects of Nitrogen Deposition on Rubus Spp. (Raspberry) Within a Central Appalachian Hardwood Forest

The impact of anthropogenic increases in nitrogen (N) deposition on aquatic and terrestrial ecosystems is topic of on-going ecological concern, with such increases arising primarily from combustion of fossil fuels and use of N-based fertilizers. Rates of N deposition that exceed biotic demand can lead to N saturation, potentially decreasing plant biodiversity. Excess N can also enhance leaching of mobile NO₃ from terrestrial ecosystems, accompanied by loss of nutrient cations, such as Ca⁺⁺, Mg⁺⁺, and K⁺. Since 1989, N has been applied aerially to a single watershed (WS3) at the Fernow Experimental Forest

(FEF), Tucker County, West Virginia. Preliminary results show *Rubus* spp. (hereafter, *Rubus*) shifting from a minor to dominant constituent of the herbaceous layer in response to N treatment. This study is part of long-term research at FEF that examines effects of excess N deposition on a hardwood forest ecosystem. The purpose of the study is to 1) quantify *Rubus* response to N treatment, 2) relate *Rubus* cover to herb layer species richness, and 3) test the hypothesis that increased *Rubus* cover will result in decreased biodiversity. Results show significant decrease in species richness along with a significant increase in relative *Rubus* cover from 1994–2013. Because *Rubus* is considered shade intolerant, these represent novel finding of increased *Rubus* cover under the closed WS3 canopy and demonstrate counter-intuitive impacts of increasing anthropogenic N on the herbaceous layer of hardwood forest ecosystems.

MS Biology, Marshall University, Huntington, WV

170 • Christopher J. Payne¹, Robert K. Peet²

Long-Term Forest Growth in a North Carolina Piedmont Forest: Examination of Recent Growth Trends Using Individual Tree Growth and Mortality Data

Studies show evidence of recent biomass increases across various forest types, including temperate forests. Some studies suggests that these trends are due to increased forest growth rates attributable to effects of climate change and fertilization effects from increased atmospheric CO2. Using a dataset of tree growth and mortality collected over the previous 80 years from 34 permanent sample plots in Duke Forest, we examine trends of biomass accumulation and tree growth in a temperate piedmont forest. We hypothesize that growth rates will exhibit above-expected increases the last 30 years, and that the trend is correlated with increased temperature and atmospheric CO2. Individual measurements of tree growth and death across all of the Duke Forest plots allow us to track broad, region-wide successional change. Individual tree height growth records provide better calculations of forest growth than estimates using diameter growth alone. Further, individual-tree mortality data allows us to determine the extent that observed trends in biomass accretion are due to shifts in mortality rates versus changes in growth rates. Additionally, knowledge of the successional age and disturbance history of the plots allows us to determine expected growth levels attributable to normal recovery processes in order to determine if growth rates are exceeding expected values. Finally, we collect regional weather and atmospheric CO2 measurements from the previous 80 years to determine if a strong correlation exists between the measured forest growth rates and observed climatic trends. Observed correlations may be a possible explanation for higher than expected levels of biomass accretion.

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171 • Elizabeth Martin, Beverly Collins

Paleoecological History of a High Elevation Valley in the Blue Ridge Mountains of North Carolina

Panthertown is a high-elevation valley in the Nantahala National Forest, and is one of few sites in western North Carolina with natural wetlands. Radiocarbon dating of multiple cores at a Panthertown valley wetland has returned basal dates of 8,000+ yr BP with nearly constant sedimentation rates. This is the oldest continuous record in the region; as such, this wetland is uniquely suited to provide information on vegetation dynamics and climatic regimes of the Holocene in the region. Using standard palynological techniques, pollen was extracted from sediment core samples and identified to genus or family at 400x; the resulting pollen percentages were used to describe the environmental history of Panthertown valley. Presence of Alnus, Salix, Asteraceae, and ferns throughout indicate a consistent open, moist site. The early to mid-Holocene (8.5-6.5 yr BP) forest appears to have been dominated by Castanea and Quercus, with minor contributions by Betula, Carya, Acer, and Pinus. The mid-Holocene (6.5-3.5 yr BP) is characterized by severe

decreases in *Castanea* and *Pinus*, with increases in *Quercus* and Poaceae,and, to a lesser extent, ferns, Asteraceae, and *Betula;* these increases coincide with a δ 13 isotope record, supporting the idea of a warmHypsithermal (8-4 yr BP). Elements of both a wetter and drier flora are present during this time. The late Holocene (3.5 yr BP -present) assemblage shows a more diverse forest, with significant contributions from *Castanea, Quercus, Betula, Pínus,* and *Tsuga*.

317

Dept of Biology, Western Carolina University, Cullowhee, NC

172 • Emily C. Adams, Frank P. Day

Blue Carbon in Coastal Freshwater Marshes on the Barrier Islands of Virginia: Aboveground Carbon Pools

Blue Carbon is a relatively new concept describing carbon distributed tidally and sequestered via net production within coastal ecosystems, including sea grass beds, mangrove forests and salt-water marshes. These systems sequester carbon at least 10 times faster than terrestrial systems. Freshwater wetlands that receive irregular tidal influence due to overwash and storm events have not been typically studied as blue carbon systems. Our objective was to quantify carbon sequestered within 4 interdunal freshwater marshes on Hog Island. VA to determine their relationship to other blue carbon systems. Marshes 1 and 2 are farthest from the ocean, below and above a berm respectively. Marshes 3 and 4 are closest to the ocean, below and above a berm respectively. Aboveground primary production was determined via harvests throughout 2013. Peak biomass in August indicated marsh 2 was highest (612 g/m^2) followed by marshes 1 (550 g/m^2), 4 (435 g/m^2) and 3 (406 g/m^2). These values are similar to biomass in salt-water marshes (80 - 860 g/m²). Peak belowground biomass was from cores taken to 1 m depth in August. Marsh 2 had more biomass (0.014 g/cm3) than marsh 1 (0.01 g/cm³) and significantly more than marshes 3 and 4 (0.008 g/cm³; 0.007 g/cm³). Decomposition was measured with litterbags collected throughout the year. All marshes exhibited slow exponential decay (k = 0.0000004, 0.002, 0.001, 0.001). Soil carbon data are being finalized, but aboveground production and decomposition rates suggest these marshes are sequestering carbon at rates similar to other blue carbon systems.

Dept of Biology, Old Dominion University, Norfolk, VA

173 • Howard S. Neufeld, Alyssa Teat

Ozone Trends in Great Smoky Mountains National Park Over the Past Two Decades: Evidence That the Clean Air Act Works

Ozone data from five sampling locations in Great Smoky Mountains National Park and one location outside the Park in NC were analyzed over the period 1989 to 2012 for diurnal and season trends. Sampling locations spanned an elevational range from 564 m at Cades Cove to 2030 m at Clingmans Dome in TN. Ozone concentrations [O₃] show an early morning minimum around 6 am at low elevations and a peak between 1 and 4 pm. High elevation sites have flatter profiles with minimum [O₃] occurring between 8 and 11 am, while maxima often occur at night. Purchase Knob in NC has lower maxima than a site at the same elevation in TN. This most likely reflects scavenging, as winds move primarily west to east, and also dilution by mixing with air in the free troposphere as it moves over the Park. Seasonal exposures increased from 1989 to 1999 and then dropped after 2003. The frequency of hours with [O₃] > 60 ppb has decreased substantially since 2003, especially at high elevation sites. This has been attributed to the implementation of the 1997 8-hour O₃ standard (NO_x SIP call) as required by the Clean Air Act, a slow-down in the economy, and turnover in the motor fleet to less polluting vehicles. These reductions show that the Clean Air Act has had highly beneficial consequences. People and natural ecosystems in the Park today are at much lower risk from tropospheric O₃ than they were a decade ago.

Dept of Biology, Appalachian State University, Boone, NC

174 • Matthew S. Herron, Joydeep Bhattacharjee

Evaluating Multiple Restoration Strategies in a 30 Year Old Bottomland Hardwood Forest Restoration Site

In the Lower Mississippi Alluvial Valley (LMAV) hydrologic modification and clearing for agriculture have led to over 75% loss of the original 10 million hectares of bottomland hardwood forest (BHF). Efforts to reforest former agricultural land have involved planting of heavy-seeded species, under the assumption that understory vegetation would return naturally. This has resulted in largely monotypic stands of oak species with closed canopies that inhibit the growth and regeneration of a more diverse mid- and understory. Select areas, however, were left fallow for research purposes and provide an important glimpse into how regeneration may have naturally occurred. Previous studies on community assembly in restored BHFs have examined either planted areas, silvicultural manipulations or passive fallow areas, but none have compared all three or taken into account landscape level factors such as edge effect, distance to nearest stream or land surface roughness. In this study, we are evaluating the effects of 3 silvicultural treatments on historic oak plantings at the Ouachita Wildlife Management Area near Monroe, LA to see how they influence understory plant diversity. We are also assessing the successional trajectories of 9 fallow and 9 planted research plots spread throughout the 5500 hectare site, to determine patterns and mechanisms of old-field assembly. We compare these different management strategies (silvicultural treatments and planted and fallow controls) in light of landscape level factors to gain a better understanding of BHF ecology and restoration. Our primary goal is to identify economically viable, ecologically sound prescriptions to aid in the future management and restoration of bottomlands across the state and the LMAV.

Dept of Biology, University of Louisiana at Monroe, Monroe, LA

175 • Eric F. Duncan, Paula C. Jackson

Comparison of Diurnal Water Use in the Native Riparian Tree Species, American Sycamore, *Platanus occidentalis* (L.), and Black Willow, *Salix nigra* (Marshall), and the Potential Implications for Riparian Restoration Efforts and Ecology

Riparian forests provide numerous environmental services such as contributing to stream bank integrity, providing nesting sites, and helping to stabilize micro habitats in and around bodies of water. Therefore restoration of these forests is an important part of protecting and maintaining healthy watersheds. We compared water use in co-occurring American sycamore and black willow growing along a stream on the Kennesaw State University campus, located in north west Georgia. For the comparison we used Granier style heat dissipation probes and an onsite weather station. Initial findings indicate the two species differ in relative amounts of water use as well as in the degree of correlation between their water use and vapor pressure deficit (VPD). Black willow appears to use significantly more water per unit of stem cross sectional area compared American sycamore. Water use in black willow also presents a stronger correlation to VPD than American sycamore. Initial findings suggest black willow may transpire at night with its transpiration potentially driven by fluctuations in VPD. These differences in water use and environmental response along with differences in species life history may have implications for riparian restoration projects and add to the understanding of riparian forest ecology.

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176 • Scott A. Abla, Laura E. DeWald

Multi-Severity Fire Effects in Xeric Oak-Pine Communities Following Small Fires in the Great Smoky Mountains National Park

Fire suppression has changed species composition in the southern Appalachians. Improved understanding of fire-related ecological mechanisms will improve effectiveness

of fire management decisions. Although occurrence of fire is known to be related to ecosystem functioning, specific effects of multi-severity fires are not as well understood. The purpose of this study was to evaluate ecosystem effects of different fire severities in xeric oak-pine ecosystems in the Great Smoky Mountains National Park (GSMNP). Plots were randomly located using satellite-based burn severity maps, and ground-truthed using the FIREMON Composite Burn Index. Variables related to stand regeneration were measured at the ground, midstory, and overstory layers among different burn severities including no-burn sites. Results showed overstory mortality increased with higher burn severity and fire at all severities reduced litter layer and shrub cover by over 50% while grass cover and coarse woody debris increased. Species richness did not differ among severities in ground and midstory layers. However, desired xeric pine and oak regeneration was greater at higher fire severity. Maple was the dominant species in the ground and midstory layers (seedlings in unburned sites, sprouts in burned sites), but midand overstory basal area decreased significantly with fire severity. Changes in species composition following fire were caused by greater amount of exposed mineral soil, increased light penetration to forest floor, and reduced midstory stem densities. These results show that fire can be used to create conditions that promote xeric oak-pine regeneration and thus help protect this ecosystem in the southern Appalachians.

Biology Dept, Western Carolina University, Cullowhee, NC

177 • Nathan M. Sedghi, Frank P. Day

Blue Carbon in Coastal Freshwater Marshes on the Barrier Islands of Virginia: Belowground Carbon Pools

Some coastal ecosystems sequester substantially more carbon than landlocked systems; the carbon associated with oceanic influences is called blue carbon. These ecosystems are disproportionally important in the global carbon budget based on their size. Most blue carbon research has focused on mangroves, seagrass beds, and salt marshes. Few studies have examined the blue carbon potential of coastal freshwater marshes. Barrier islands frequently flood, with seawater reaching interior ecosystems. We examined freshwater marshes on Virginia's barrier islands for their possible role as blue carbon systems. We studied four interior marshes on Hog Island, which varied in proximity to the ocean and a trail berm. Sediment deposition was measured using sediment plates, root decomposition was measured with litterbags, and BGNPP was quantified using in-growth cores. There were no significant site differences in inorganic sediment deposition. BGNPP was significantly greater for sites closer to the beach (256 g m⁻² yr⁻¹) than farther sites (191 g m⁻² yr⁻¹). BGNPP was significantly greater for sites below the berm (271 g m⁻² yr⁻¹) than for sites above the berm (176 g m⁻² yr⁻¹). Decay rates for sites close to the beach (k=0.00275 day⁻¹) were greater than for sites farther from the beach (k=0.00145 day⁻¹). Unexpectedly, decay rates at sites open to the ocean (k=0.00179 day¹) were less than rates behind the berm (k=0.00235 day⁻¹). These sites were generally less productive belowground than salt marshes and root decay rates were generally higher than in mid-Atlantic salt marshes.

Dept of Biology, Old Dominion University, Norfolk, VA

178 • Elizabeth D. Evans, Safaa H. Al-Hamdani, Benjamin Blair

Physiological Responses of Roselle (Hibiscus sabdariffa) to Drought Stress and Determination of Antioxidant and Nutrient Content

Roselle (*Hibiscus sabdariffa*) belongs to the Malvaceae family. It is an erect, mostly branched, annual, herbaceous subshrub that grows mainly in warm and humid tropical and subtropical climates. Roselle calyces have been used in folk medicines for many years and have been proven to lower blood pressure in patients with hypertension and type II diabetes. This research project was carried out to examine the effect of drought on inducing elevation in antioxidant content in the calyxes. Additionally, selected physiological responses of roselle to drought were examined. The plant appeared to osmotically adjust to drought and the total phenolic compounds were elevated in the

stressed plants. The photosynthetic rate, stomatal conductance and photosynthetic pigments were significantly reduced in the stressed plants. Additional experiments were carried out in the field to evaluate the nutrition value of the stem, leaf and calyxes of two roselle varieties (thai red and red drops). The two varieties appeared with relatively high accumulation of micronutrients and macronutrients and with the calyx protein content of 5.19% and 20.1 and 62.7 ADF and TDF respectively. The collective data from this research can be utilized to promote the hypothesis that roselle can be utilized as an excellent source for supplemental food for human consumption and should be promoted commercially.

179 • Austen C. Stoelting¹, Safaa H. Al-Hamdani¹, Mustafa Morsy²

Selected Physiological Responses of Tomato Plant to Drought and High Temperature as Influenced by Symbiotic Interaction With Curvularia Virus and Curvularia protuberata Fungus

This study was carried out to evaluate the symbiotic interaction between Curvularia Thermal Tolerance Virus (CThTV), Curvularia protuberata, and tomato plant (Solanum lycopersicon) in combating drought and high temperature. The plant was germinated under greenhouse conditions and the seedlings were divided between three treatments, plants free of the virus and fungus (control); plants inoculated with the virus and fungus; and plants inoculated with just the fungus. Twelve selected samples from each treatment were individually planted in one gallon pots containing organic potting soil. The plants were allowed to grow for two weeks to ensure healthy establishment. The drought treatment was applied to all three treatments by holding the watering process. After two weeks, the plants started showing visible symptoms of drought, including wilting and slight chlorosis. Physiological measurements of six plants from each treatment were taken to determine the impact of drought. Photosynthetic measurements, photosynthetic pigments, plant dry weight, osmotic potential, and total soluble sugar content were not significantly different among all the treatments. The plants' response to drought appeared to have similar results during pre- and post-anthesis, indicating that the symbiotic interaction between the virus, fungus, and plant had no impact on drought tolerance of the tomato plant. The second experiment was carried out using plants inoculated in the same way as above to determine the impact of the three-way interaction on heat tolerance. Four randomly selected plants were assigned from each treatment to the heating units and allowed to grow for seven days. The temperature of the heating units was adjusted to 45°C during the 14 hours of daylight to 25°C during the night. The plants growing under symbiotic association with the virus and fungus showed the least wilting symptoms followed by the virus-free plants, and the control. Photosynthetic rate was significantly higher in the symbiotic plants with both the virus and fungus, followed by virus-free plants, and the control. However, stomata conductance and photosynthetic pigments did not show significant differences between the treatments

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180 • Thomas E. Hancock¹, William K. Smith²

Barrier Island Dune Vegetation in the Southeastern United States: Future Survival at the Land-Sea Interface

The land-sea interface is a dynamic environment that has drawn the attention of plant biologists since the inception of the field of ecology. Few areas exhibit such distinct zonation patterns in response to abiotic factors including salt spray, overwash, low water content of the substrate, low nutrient availability, high light intensity, abrasion and episodic burial by sand. Although not reviewed in the past twenty-four years, an extensive body of ecological literature exists for the coastal southeastern U.S. including work that focuses on dune stabilization through beach fencing and revegetation. In contrast, little work has been conducted using modern ecophysiological methods first developed in the 1970s. These methods, along with advances in micrometerological instrumentation, allow today's researchers to more precisely measure abiotic microenvironments and corresponding plant physiological processes in response to daily, seasonal and episodic stress factors.

From these studies, predictions can be made concerning the future of dune plant populations along the southeastern United States in relation to climate change impacts such as increased sea level or the frequency and intensity of storm events. Here we review existing ecological and ecophysiological literature on coastlines, predictions for future dune plant populations, and address new avenues of research.

181 • A. Renee Fortner¹, Claudia L. Jolls², Carol Goodwillie³

Limited Seed Set and Germination Cues of the Federally Endangered Perennial,&Nbsp; Thalictrum cooleyi, Ahles

Thalictrum cooleyi Ahles, is a dioecious species, endemic to the coastal plain of the southeastern US, listed as federally endangered in 1989. We lack biological knowledge for Thalictrum cooleyi, e.g., its reproductive ecology, critical to prioritize and effectively implement conservation efforts. During the summer of 2013, I documented: 1) sex ratios at three NC sites, 2) potential pollen limitation, and 3) average seed set in the field. Deviations from a 1:1 functional sex ratio were found at two of the three sites surveyed. I performed a pollen supplementation experiment to compare seed set in 37 females at three sites. Percent seed set was 67% in hand pollinated flowers, greater than in open pollinated controls (35%), an indication of pollen limitation. Average seed set per flower in the field was 62% at one site surveyed (n = 226). In comparison, average seed set per flower was 45% for plants grown without assisted pollination inside environmental growth chambers and a greenhouse (n = 368). Seed mass ranged from 1.22-6.01 mg (mean \pm SE = 3.02 \pm 0.02, n = 1171). Preliminary data suggest seeds are dormant at maturity. I also selected seeds of known mass to test for factors which might influence germination: seed age, exposure to gibberellic acid, length of cold stratification, and light exposure during incubation. My results suggest that low seed set from pollen limitation, and complex seed dormancy and germination cues, coupled with habitat degradation, limit successful sexual reproduction of Thalictrum cooleyi.

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182 • Rebecca K. McKee¹, Kristen K. Cecala², Michael E. Dorcas¹

The Effect of Bycatch Reduction Device Presence and Orientation on Diamondback Terrapin Capture and Behavior

Diamondback terrapins (Malaclemys terrapin) have experienced declines throughout their range, and accidental mortality in crab traps is a significant conservation concern. To minimize the risk of terrapins entering crab traps, researchers have suggested the use of bycatch reduction devices (BRDs) to reduce the size of crab trap openings and thereby exclude terrapins from entering crab traps. Despite these recommendations, few studies have observed terrapin behavioral interactions with BRDs and the effectiveness of these devices at preventing entry of smaller terrapins into crab traps. The objective of our study was to determine the effect of BRDs and bait on blue crab and terrapin behavior and overall capture abundance. We observed terrapin behavior when crab traps were baited with a variety of commonly used baits and with vertical and horizontal installation of BRDs. Overall, terrapins investigated crab traps more frequently when the traps were baited with mackerel versus chicken or crab, and the terrapins were captured more frequently when BRDs were not installed on the trap. The presence of the BRDs also increased the length of time necessary for a terrapin to enter the traps and decreased the proportion of entries relative to the number of investigations. Understanding these interactions will better allow us to recommend regulations to prevent the continued decline of terrapin populations due to blue crab fisheries while maintaining or improving the blue crab catch.

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183 • Joanna E. Hawley Howard¹, Rob F. Baldwin¹, Amber L. Pitt², Elizabeth D. Baldwin¹

The Utility of State Parks as a Conservation Tool for Isolated and Ephemeral Wetlands: A Case Study From the Southern Blue Ridge

Biodiversity management has been confined to parks and protected areas and these types of formally-protected areas may help mitigate the effects of climate change and habitat loss by preventing further habitat fragmentation. State parks (SP') may provide a type of a priori conservation, allowing ecologically significant areas within SP boundaries to be more rapidly prioritized for conservation. Our goals for this study were to use the SC state park system to examine the structural and functional differences between wetlands located inside vs. outside the SP system. We hypothesized that wetlands within SPs would have better water quality and higher species richness compared to non-park wetlands. We collected environmental and biotic community data from each study wetland (N = 41, park pool = 19, non-park pools = 22) during 2010 and 2011. Our study revealed that wetlands outside of SPs exhibited less variable depths and were deeper on average than park pools. We found significant differences in total taxonomic richness, invertebrate tolerance values and wetland depth between park and non-park wetlands. We relied heavily on local ecological knowledge (LEK) for location information on wetlands within parks. Additionally, our interactions with the public during our site visits were educational for both researchers and citizens. State parks provided important study sites, various personnel with LEK, and an a priori framework for conservation at the local scale which can help bolster conservation efforts at larger scales. We posit that state parks are an under-utilized but extremely important resource for filling the gaps in conservation.

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184 • Ryan C. Ernstes, John E. Quinn

Shift in Songbird Vocalizations Suggest Possible Threats of Acoustic Masking for Human Health

Global change, including increased anthropogenic noise, has been linked to multiple human health concerns. To further examine potential impacts of rising anthropogenic noise on health, we conducted an acoustic analysis of the response of songbird vocalizations in upstate South Carolina to traffic noise across an urban-rural gradient. Our data demonstrate that even moderate levels of noise alter the structure of avian vocalizations. In particular, Brown-headed Nuthatch (Sitta pusilla) bottom of vocalizations shifted upward to avoid overlap with the increased ambient noise associated with vehicular traffic. Eastern Towhee (Pipilo erythrophthalmus) bottom of vocalizations display the same shift, though only in the final 'tea' component of their call. Vocalization adjustment to overcome acoustic masking reduces reproduction and survival and the effects of noise pollution on inter-species reactions are only now being identified. Understanding the impacts of anthropogenic noise on bird health provides insignt into ecosystem health as well as human health. Thus it is essential that we understand the impact of this noise pollution on the ecosystem and implement effective and efficient conservation strategies to protect global ecosystem and human health.

Furman University

185 • John E. Quinn

Protecting Species in Unexpected Places: An Opportunity for Conservation in Managed Ecosystems

The need for species conservation beyond protected areas is evident. However, for efforts to be successful, data are needed to identify novel conservation opportunities. Thus, to assess the conservation value of shrubland habitat embedded in different land uses, we evaluated nesting success of a shrubland bird species of conservation concern, Bell's

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Vireo (Vireo belllii). We classified field sites in one of three landscape categories; protected area, conventional farmland, and organic farmland and estimated percent cover of different local land uses at 50m from each nest. Estimates of daily nest survival rate were modeled in Program MARK. We located sixty-five nests between May 1 and August 1, 2012. We found most nests in shrubland embedded in protected habitats, followed by organic, and conventional farmland. Of these, fifty-six had at least one egg. Percent nest success (measured as at least one fledgling leaving the nest) was not different between landscape categories, nor was there any difference based on the type of dominant land cover. Seven nests were parasitized by Brown-headed Cowbirds. No difference in rates of parasitism was evident between farmland and protected areas. Analysis of nests not parasitized suggests DSR is influenced by both crop and non-crop land use patterns. DSR was lowest at nests embedded in alfalfa fields and adjacent to roads. DSR was greatest at nests adjacent to mowed grass strips and soybean fields. These data identify costs and benefits of multiple land use types not always considered in conservation for species of conservation concern.

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186 • Samantha L. Poarch, Joseph M. Morrissey, Theodore V. Khleborod, Jonathan J. Storm

Small Mammal Community Structure Within Urban Greenways

Urbanization leads to the removal of natural habitats and is a major contributor to the loss of biodiversity. The retention of greenways is one method to mitigate the loss of wildlife habitat within urban and suburban areas. Urban greenways are linear parklands maintained in a more natural condition than typical urban parks. Although several studies have addressed the use of urban greenways by birds, little is known regarding their impact on mammal populations. We sought to determine if urban greenways in Spartanburg, South Carolina have a small mammal community similar to that of forests in rural Spartanburg County. In addition, we wanted to determine whether vegetation density influences the abundance of white-footed mice (Peromyscus leucopus). During May and August of 2013, we live-captured small mammals at 4 urban greenways and 2 rural forests. We then used a profile board to visually estimate the density of vegetative cover at 20 randomly selected locations within each study site. The white-footed mouse was the most abundant small mammal at 5 of the 6 sites, comprising 50 - 100 % of all individuals captured at urban greenways and 59 - 83 % of all individuals at rural forests. The golden mouse (Ochrotomys nuttali) was the second most abundant small mammal. Vegetation density was significantly higher within urban greenways than at rural forests. Across all study sites, we found a positive trend between vegetation density and the abundance of white-footed mice. Our results suggest that urban greenways provide suitable habitat for native small mammals in SC.

Division of Natural Sciences and Engineering; 2 University of South Carolina Upstate; 3 Spartanburg, SC

187 • Melissa D. Caspary¹, James Rickard²

Population Dynamics of the Rare Relict Trillium (Trillium reliquum)

Populations of the federally endangered relict trillium (*Trillium reliquum* Freeman) were surveyed for two years to determine status and reproductive success. By focusing on conserved populations and those with conservation potential, we intended to define how close existing conserved populations are to the recovery goal and determine any threats to populations that occur on protected lands. Identification of management needs and prioritizing conservation protection for existing populations were also study objectives. Specifically, we wanted to estimate the size of the trillium population (mature, juvenile, and reproductive individuals) at each site in each year (2011 and 2012) and on average; compare the density of the trillium population (mature, juvenile, and reproductive individuals) across years to determine whether populations are increasing, decreasing, or remaining stable; estimate herbivory damage; and, estimate the invaded proportion of

plots at each site. Data was collected from 14 sites in Georgia and South Carolina. These survey efforts were successful in identifying where robust populations of the relict trillium occur to satisfy recovery plan objectives, and where protected populations of adequate size are missing. A regression analysis was used to identify patterns in herbivory and invasion and identify those sites with significantly higher rates of both. The proportion of points suffering from invasion in 2012 was not significantly different from that in 2011 and differences in invasion varied significantly among sites. These analyses did highlight sites where additional management efforts are warranted to ensure trillium population success.

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188 · Avery A. Olearczyk

Fire&Rsquo;S Impact on Den Creation for Petaurus australis In Eucalyptus grandis Trees

The Yellow-Bellied Glider, P. australis, of northeastern Australia dens in the hollows of E. grandis trees over 99.5 cm diameter at breast height in Wet Sclerophyll Forests. This study compared E. grandis trees in this size class possessing potential P. australis dens (den trees), with E. grandis trees of the same size without any potential of dens (non-den trees). This study investigates the role fire may play in the development of dens since it is known that fire increases tree susceptibility to termite and fungal infestations, facilitating tree hollowing which creates suitable P. australis dens. Den and non-den trees were compared for differences in respect to the number and size of fire hollows. Canopy and sub-canopy measurements were also taken surrounding the den and non-den trees. Den trees had significantly more fire hollows than non-den trees. Fire hollows were also significantly larger in den than in non-den trees, indicating that den trees were subjected to much higher intensity fires. The average number of trees found in the canopy was significantly higher around den trees, and the average number of trees in the sub-canopy was significantly lower around den trees than non-den trees. Results of this study imply necessity for high intensity fires in the Wet Sclerophyll Forest for the creation of suitable den habitats for P. australis gliders.

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189 • Shannon E. Pittman¹, Ranjan Muthukrishnan¹, Natalie M. West², Adam S. Davis², Nicholas R. Jordan³, James D. Forester¹

Mitigating the Invasive Spread of an Exotic Biofuel Crop. Miscanthus × giganteus

Herbaceous perennial crops are becoming a larger component of bioenergy production both in the United States and worldwide. However, there is growing concern that perennial crops pose a substantial risk of biological invasion as a result of the same traits that make them ideal for bioenergy production: low nutrient requirements, fast growth, and drought tolerance. Miscanthus x giganteus is a sterile perennial grass native to Asia which generates high fuel yeild even in northerly latitudes. Because of its low nutrient requirements, M. x giganteus has been proposed as an ideal biofuel crop for planting on marginal lands unfit for food production. A fertile variety of M. x giganteus was recently developed in an effort to decrease the costs associated with planting rhizomes of the sterile variety. However, no management practices are required by the Environmental Protection Agency to limit the spread of the fertile variety. We implemented a spatiallyexplicit population model of fertile M. x giganteus to determine the efficacy of potential management strategies on limiting or slowing the spread of the species. We found that implementation of buffer zones surrouding fields and early harvesting times could drastically reduce spread in some landscapes, but extensive spread was likely in all scenarios investigated. Fertile M. x giganteus may be planted in locations devoid of suitable habitat outside of planted fields, such as within corn fields, with limited risk of spread. However, if M. x giganteus is planted on marginal lands adjacent to potential habitat, buffer zones and early harvesting may substantially reduce the rate of invasive spread.

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325

190 • Ryan Walsh¹, Thomas Hancock², Patrick Amico³

The Effects of Beach Nourishment on Surfzone Fisheses and Macroinvertebrates of Bald Head Island, NC (USA)

Recently beach nourishment has become the favored method of maintaining recreational beaches along the Southeastern and Gulf Coasts of the United States. Beach nourishment is often viewed as more environmentally friendly when compared to hard stabilization. A growing body of literature, however, demonstrates that beach nourishment has dramatic impacts on the surfzone and nearshore environments. This study examined the effects of one beach nourishment cycle on fishes and macroinvertebrates living in the surfzone of Bald Head Island, NC (USA). Fishes were collected with a 9m X 1,5m seine net (three replicates) in the surfzone at two locations (one nourished site and one nonnourished site) along the south beach of Bald Head Island. Invertebrate abundance was recorded in one-liter sediment samples (three replicates). Water quality parameters were also measured at each site. Sampling took place at least once per month from June 20. 2012 to October 13, 2013. Generally, there were more fishes at the non-nourished site. although not statistically significant. Invertebrate counts were significantly higher at the non-nourished site. When seasonal patterns, water quality parameters and nourishment cycle data were overlain, effects of beach nourishment on the local invertebrate community (and to some extent fish community) were evident. Although beach nourishment may be less impactful than other stabilization methods, it does appear to have an effect on the surfzone community of Bald Head Island.

¹ Bald Head Island Conservancy; ² Methodist University; ³ Ft. Fisher State Recreation Area

191 • Matthew J. Heard¹, Katherine F. Smith², Kelsey J. Ripp², Melanie Berger², Jane Chen², Justin Dittmeier², Maggie Goter², Stephen T. McGarvey³, Elizabeth Ryan²

Threats From Disease Increase as Species Move Closer to Extinction

Infectious diseases can pose a significant threat for wildlife species across the world. For those species at risk of extinction from disease, important questions remain unanswered including when on the path towards extinction does disease become a threat and does it co-occur predictably with other threats. Using data from the International Union for Conservation of Nature (IUCN) Red List, we examined the relative role and co-occurrence of threats associated with amphibians, birds, and mammals at six levels of extinction risk (i.e. Red List status categories: least concern, near threatened, vulnerable, endangered, critically endangered, and extinct in the wild/extinct). We tested the null hypothesis that the proportion of species threatened by disease is the same in all six Red List categories. We determined that the proportion of species threatened by disease varied significantly between Red List categories and increased for amphibians, birds, and all species combined as they move from least concern to critically endangered. We also found that disease was infrequently the sole threat impacting species. However, we determined that when species were negatively affected by other threats (e.g. land use or invasive species) they were more likely to be simultaneously threatened by disease. Some potential drivers of these trends include ecological factors, discovery bias among species at greater risk of extinction, clustering of phylogenetically related species in status categories, and data availability. Ultimately, these findings echo calls for baseline data on the presence of disease in species prior to being threatened with extinction.

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192 • Justin D. Latoni, Erin L. Quinlan

Estimating Urban Amphibian Diversity Using Modified Funnel-Traps

Amphibians are declining worldwide due to contaminants, habitat loss, and introduced species. For these reasons, urban or heavily developed areas can be particularly challenging for amphibian populations. The objective of this study was to document the presence of amphibian populations within an urban college campus in Lawrenceville, GA in 2013-2014. Sampling techniques included; dip nets, call tracking, pitfall traps, and funnel traps. It was hypothesized that more amphibians would be observed in or near traps that contained a light source as opposed to those that did not. This was tested with the use of funnel traps in two local aquatic environments; a pond and a stream on the Georgia Gwinnett College campus. Large populations of anurans, specifically *Lithobates catesbeianus* and *L. clamitans*, were observed in the pond habitat, while lungless salamander populations, primarily *Eurycea* spp. and *Desmognathus* spp., were observed in the stream. The results of the funnel-trap experiment, with and without light sources, yielded varying degrees of success in the pond habitat. Collections within the stream habitat are ongoing and will be completed within the spring season.

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193 • Elliott P. Gibbs, Adrian K. O. Hayes, Melissa A. Pilgrim

Development of an Automated Computer Recognizer That Isolates *Hyla cinerea* Breeding Calls From Sound Files

Two common techniques for monitoring anurans that take advantage of male breeding vocalizations are call surveys and Automated Recording Systems (ARSs). With mass digital storage becoming more affordable, the appeal of digital ARSs has greatly increased. Unfortunately, the volume of recordings produced from ARSs can present logistical difficulties for researchers who must listen to the files. In an effort to reduce the time necessary to manually listen to ARS recordings for calling Green Treefrogs (Hyla cinerea), we used Song Scope to develop an automated computer recognizer for the species. We collected individual treefrog recordings in the field using solid state-recorders with a 460mm shotgun microphone at a distance of ~0.3m from calling frogs. We annotated (i.e., manually identified target portions of the sound file spectrograms that corresponded to quantitative call characteristics) 800 Green Treefrog calls and used the annotations to parameterize our recognizer. We tested the recognizer using 100 ARS breeding chorus recordings (50 contained H. cinerea vocalizations, while the remaining 50 did not). The true positive rate (recognizer correctly identified sound files that contained H. cinerea vocalizations) associated with our recognizer was 85.7%, while its false negative rate (recognizer missed sound files containing H. cinerea vocalizations) was 24.1%. Thus, the accuracy of our recognizer was 80% and its precision was 85.7%. Our work refining automated computer recognizers stands to benefit other researchers interested in using the technology to inventory and monitor anuran populations, and improve standards for use of computer recognizers as tools in ecological research.

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194 • Carlos D. Camp¹, Jessica A. Wooten², Zachary I. Felix³

A Contradiction in Genes: Phylogeography of the Black Mountain Salamander (Desmognathus welteri Barbour 1950)

The development of modern molecular techniques has led to the discovery of previously unsuspected levels of genetic variation, particularly within taxa characterized by morphological conservatism and/or rampant homoplasy. The lungless-salamander family Plethodontidae is characterized by both, and molecular-based investigations of phylogeography have uncovered a number of cryptic lineages, including many that have subsequently been described as species. An important phylogeographic tool continues to be the sequencing of mitochondrial DNA (mtDNA), which is especially useful for analyses

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at the specific and generic levels because of its rapid rate of nucleotide substitution relative to nuclear genes (nDNA). MtDNA has been criticized as a phylogenetic marker, however, because it represents only a small fraction of an organisms' genome and is inherited strictly maternally. In fact, recent studies have indicated that mitochondrial-based and nuclear-based conclusions regarding phylogeny may sharply disagree. We used both mitochondrial (ND2, COI, 12S) and independent nuclear (introns of ILF3 and GAPD) genes to investigate the phylogeography of the Black Mountain Salamander (Desmognathus welteri Barbour 1950). We found that both nuclear introns exhibited considerable genetic structure among populations but that mtDNA sequences showed hardly any variation across the entire geographic range. The most parsimonious explanation is that the mitochondrial genome has undergone a relatively recent selective sweep in this species. Our results underscore the need to use caution when drawing phylogenetic conclusions from mtDNA sequences.

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195 • Erin L. Quinlan, Tatiana A. Giraldo

Bioacoustic Monitoring of Amphibian Diversity and Behavior in an Urban Environment

Automated recordings of anuran mating calls were used as a non-disruptive technique to determine species richness on an urban campus. Automated recording loggers were deployed at two pond sites and a stream site at Georgia Gwinnett College, Lawrenceville, GA in 2013. Loggers recorded sounds and temperatures between 8 p.m. and 2 a.m. It was hypothesized that in addition to species richness, the loggers may indicate specific mating call behaviors, such as timing, frequency, and duration of the calls. The pond habitats had the most abundant frog calls and included American bullfrogs (*Lithobates catesbeiana*) and green frogs (*Lithobates clamitans*). The stream site had the highest anuran species richness, including the bird-voiced tree frog (*Hyla avivoca*) and other tree frogs (*Hyla chrysoscelis, H. veriscolor*, and *H.cinerea*). Gray tree frogs (*Hyla versicolor/chrysoscelis*) were recorded only during the last week of May and first two weeks of June at all sampling sites. These species were specific in the times and dates of calling, particularly in areas with large predatory anurans, such as the bullfrog. This behavior may be a consequence of predator avoidance and/or competition with other calling anuran species.

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196 • Timothy E. Baldwin¹, Yong Wang², Callie J. Schweitzer³

The Influence of Forest Management Practices on Amphibian Accessibility, Larval Performance, and Adult Choice Within the Cumberland Plateau in Grundy County, Tennessee

The purpose of this project was to assess the influence that forest disturbance has on pool breeding amphibian reproductive success. This experimental study was executed within Burrows Cove in Grundy County, Tennessee. A split-split plot design was used to examine the effect forest treatment (main factor), distance to forest edge (sub-factor), and variation in amount of light reaching the pools (split-split factor) on amphibian breeding parameters. The forest treatments included: control with gaps (five replications), shelterwood (four replications), and an oak shelterwood (five replications). Three artifical ponds were established at each of the three distance categories (ten meters, fifty meters, and one hundred meters) in each of the forest stands. Three pools at each distance were randomly assigned to allow thirty percent, fifty percent, and eighty four percent of the light relative to control stands to reach the pools using light screens. Artifical pools were monitored over two breeding seasons. A repeated measures analysis of variance (SPSS 19.0) was used to compare amphibian species abundance across different treatments. along the distance gradient, among the different canopy treatments, and between the two breeding seasons. Multiple linear regression (SPSS 19.0) was used to compare the local and stand level environmental variables to amphibian species abundance. In the field experiment, eight amphibian species were identified, 4,324 larval amphibians were counted, and 146 (5,776 embryos) amphibian egg masses were tallied. Larval amphibian abundance was higher within the shelterwood treatment and the thirty percent arrays.

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197 • Thomas P. Wilson¹, Paul-Erik Bakland¹, Nyssa Hunt¹, Simone Madsen¹, Preston Prigmore¹, Robert Altonen¹, Sarah Bohr¹, Brittany Bird¹, Tabitha M. Wilson²

In the Shadows of a Brownfield: Nest Site Selection by Marbled Salamanders (*Ambystoma opacum*) in an Isolated Wetland in Southeastern Tennessee

Amphibians have complex life cycles and most require unrestricted access to both upland and wetland habitats. A critical component of amphibian life history is nest site selection, and this can be fairly dynamic at a variety of spatial and temporal scales. We examined biophysical aspects of nest site selection of Marbled Salamanders (Ambystoma opacum) at a wetland adjacent to an industrial development in southeastern Tennessee. We conducted nest site surveys daily from 10/15/13 to 10/31/13. We targeted all representative habitats in the wetland, yet most nests were detected in the wetland-upland interface. We generated random points based on each nest as a means to compare the biophysical conditions in areas where nests were present versus undetected. We recorded data for 40 nests over a suite of biophysical variables that included, water depth, distance from nearest water, distance from hydrologic boundary, percent cover, soil type. elevation, and aspect. After we described the physical nest site and surrounding landscape, we constructed a predictive model using regression and Akaike Information Criterion to rank and evaluate the associations between nest sites and biophysical features. Marbled Salamanders selected nest sites that had hydric soils with abundant cover but not ranging too far from standing water. Our data suggest that Marbled Salamanders select sites in a non-random fashion, and did not nest in all available microhabitats. Stakeholders can use this information that incorporates hydrology and vegetation structure to make informed decisions that benefit this species.

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198 • Adrian K. O. Hayes, Elliott P. Gibbs, Melissa A. Pilgrim

Interspecific Variation in Nocturnal Calling Activity of Anurans Influenced Call Survey Estimates of Species Occurrence in the Piedmont Region of South Carolina

The North American Amphibian Monitoring Program (NAAMP) uses a standardized call survey protocol to evaluate presence and persistence of anurans in a region. One aspect of NAAMP protocol is that stops along a call survey route must be conducted in sequential order between thirty minutes after sunset and one in the morning. Such a sampling regime introduces potential temporal bias to call survey data if anuran calling activity changes through the night. Our study objectives were to evaluate (1) whether anurans in our region showed temporal variation in calling activity through the night and (2) if patterns in calling activity through the night impacted sampling effort necessary to detect anuran species. To address our objectives, we used Automated Recording System (ARS) sound files recorded at four wetlands in the Piedmont region of South Carolina from May 13th - June 17th, 2012 (dates overlapped NAAMP Sampling Window 3), Using NAAMP protocol, we completed 560 call surveys at four five-minute recording periods (i.e., 21:30, 22:30, 23:30, and 00:30). Logistic regression analyses revealed that calling activity of Acris crepitans, Lithobates catesbeianus, and L. clamitans significantly increased further from sunset, while calling activity of Anaxyrus fowleri, Hyla chrysoscelis, and H. cinerea significantly decreased further from sunset. The influence of time on anuran detection was most pronounced for A. fowleri and H. cinerea, where reversing the sequence of call survey completion at least doubled the sampling effort necessary to detect each species. Our research indicated that NAAMP protocol may underestimate anuran occurrence in our region.

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199 • Alyssa A. Hoekstra, Vincent A. Cobb

Thermal Ecology of the Timber Rattlesnake (Crotalus horridus) in Middle Tennessee

Timber Rattlesnakes commonly make lengthy movements to and from foraging areas during their active season, exposing them to a variety of habitat. In the Eastern U.S., fragmented habitats have become common and are generally considered a negative environmental feature in snake ecology studies. Because of the importance of body temperature selection in snakes, we hypothesized that these fragmented habitats might limit movement patterns due to differences in the availability of appropriate temperatures. Using radio-telemetry and temperature loggers we recorded body temperatures of freeranging timber rattlesnakes during their active season. We also used operative snake models to monitor the thermal characteristics of four different habitat types that are frequently used by this snake population. We found that body temperatures of snakes were within or below the range of available environmental temperatures depending on the type of habitat. Open canopied habitats offered a wide range of temperatures with higher extremes than forested habitats but were only used by snakes if they chose patches of dense vegetation within. Additionally, snakes commonly used the open habitat edges. Operative models indicated that habitat edges had steep thermal gradients. This study suggests that altered and fragmented habitats with limited microhabitat diversity can provide appropriate shelter from extreme environmental conditions but may dictate snake movements potentially making them predictable targets for predators.

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200 • Soraya M. Bartol¹, Ian K. Bartol², Ashley L. Lavender²

Assessment of Sea Turtle Hearing: Pros and Cons of Electrophysiological and Behavioral Techniques

Direct testing of sea turtle hearing has primarily involved electrophysiological techniques. In my laboratory over the past 20 years, we have tested hearing in sea turtles using boneconduction, aerial acoustic stimuli, and underwater sound sources to record either auditory evoked potentials (AEPs) or auditory brainstem responses (ABRs). While we have been able to identify sea turtles as low frequency specialists using these approaches, reliably determining threshold levels has been a significant challenge because of high variability among test subjects and the lack of correlation of electrophysiology data with behavioral responses. For many animals, behavioral audiograms are the standard for defining hearing range and sensitivity because behavioral audiograms illustrate the lowest detectable sound that will elicit an action response from the animal. Recently, my research group sought to evaluate whether hearing frequency range and threshold sensitivity are uniform between behavioral and electrophysiological tests. While hearing frequency range (50-1000/1100 Hz) and highest sensitivity (100-400 Hz) were consistent in audiograms for behavior and AEP experiments, loggerhead sea turtles (Caretta caretta) had significantly higher AEP-derived (mean = 126 re 1 µPa over hearing range) than behavior-derived (mean = 98 re 1 µPa over hearing range) auditory thresholds. Although behavioral testing is a more sensitive auditory assessment technique, there are practical constraints of this approach, which are not as problematic for AEP testing, including significant training time, extensive husbandry resources, and special permitting. These limitations, as well as the limitations of electrophysiological approaches, need to be considered when designing sea turtle hearing experiments.

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201 • Matthew K. Gaylord¹, Glenn R. Parsons²

Functional Morphology of the Hammerhead Shark Cephalofoil: An Assessment of the Hydrodynamic Lift Hypothesis Using Computational Fluid Dynamics

The hammerhead sharks (Family: Sphyrnidae) are all characterized by head morphologies that are strongly expanded laterally and dorsoventrally flattened. Many theories have been proposed regarding the functional aspects of this structure (termed the cephalofoil). One of these is that it may produce dynamic lift in similar fashion to a cambered wing, aiding them (like the swim bladder of bony fishes) in maintaining vertical station in the water column. Shark specimens were obtained from a variety of sources including fishing tournaments, private fishermen, commercial fishing vessels, and museum collections. Plaster head models were cast of each species. These physical models were digitized using a Faro-Arm laser scanner, and the resulting data were imported using Geomagic Studio 10 software at Mississippi State University (MSU). Unsteady, 2nd-order Navier-Stokes solutions were computed using the U²NCLE unstructured flow solver (a parallel flow simulation code developed at MSU which solves the Unsteady Reynolds-Averaged Navier-Stokes equations) to model the surrounding flow field and associated forces. A family-wide computational fluid dynamic (CFD) analysis was performed from laser-digitized head morphologies to quantify lift and drag forces. Carcharhinid species were included for comparison. The cephalofoil appears to produce substantial lift forces only when at some angle of incidence to the flow. Species with this head morphology, meanwhile, appear to be characterized by greater drag than their carcharhinid counterparts. The ecophysiological implications of our results are integrated with knowledge from previous studies and new hypotheses are formulated from the resulting

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202 • Richard Carter

Digitization of the Valdosta State University Herbarium

The Valdosta State University [VSU] Herbarium comprises more than 65,000 dried plant specimens used in research and teaching. It is the second largest herbarium in Georgia and is a rich repository of data emphasizing the flora of the coastal plain region of Georgia and, more generally, the flora of the southeastern United States. The VSU Herbarium has extensive holdings of sedges (Cyperaceae) and other graminoid families and bryophytes. In 2011, the National Science Foundation funded a three-year project to support digitization and general enhancement of the collection. Subsequently, more than 65,000 specimens have been imaged, and label data from more than 60,000 specimens have been digitized. General enhancement has included purchase of additional herbarium cabinets, replacement of worn seals in old cabinets, replacement of old genus folders with geographically color-coded archival folders, and processing of a large backlog of specimens. Much of this effort has been accomplished by undergraduate student assistants, and through this project eleven students have been trained in basic herbarium curation and digitization methods. It is anticipated that this project will be completed by the close of 2014, and current efforts have shifted toward processing of the specimen backlog and georeferencing.

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203 • Michael O. Holt1, Richard Carter2

The Valdosta State University Virtual Herbarium

Collaboration between the Odum Library and the herbarium of Valdosta State University has produced a web interface to serve herbarium specimen data and images on-line. Source code, generously provided by the R.K. Godfrey Herbarium of Florida State University, was adapted to fit the schema of the Specify 6.5 database used by the VSU Herbarium. The source code is written in php and MySQL, with some Javascript

components. Through the Valdosta State University Virtual Herbarium web interface, users can query to retrieve specimen images and data, distributional maps, and customizable reports. Password protection and redaction of label data on images restrict sensitive locality information for rare, threatened and endangered species to authorized users. The Valdosta State University Virtual Herbarium source code adapted for use with Specify 6.5 is available at no cost to interested parties.

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204 • Phillip D. Lowe, Richard Carter

Two Birds With One Stone: Using Excel and Mail Merge to Create Herbarium Specimen Labels in Word and Populate a Specify Database

We describe a method that uses Microsoft Excel to pivot between Microsoft Word and Specify 6. Field data are digitized from the field notebook into a formatted Excel document, then the Mail Merge feature of Word is used to format the digitized field data to produce customized herbarium specimen labels. Once the labels have been generated, the specimens mounted, and their barcode labels attached, the barcode catalog numbers are scanned into the designated field in the Excel spreadsheet, providing the unique identifier required by the Specify database for each specimen. Subsequently, the data in the Excel spreadsheet are uploaded to the database through the Specify 6 Workbench. This system is flexible, efficient, and easy to use. It allows for customized formatting of herbarium specimen labels and eliminates keystroking of data into the database. This work was made possible through the support of the National Science Foundation (DBI 1054366, J.R. Carter, PI).

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205 • Anna K. Monfils1, Gil Nelson2

Recruiting and Retaining Small Natural History Collections in the National Digitization Initiative

Small natural history collections constitute a major source of information for understanding North America's biodiversity. Typically regional in scope with strong ecological, taxonomic, and geographic biases, they frequently hold specimens that are unduplicated in larger collections and represent intense samplings of community composition that have the potential to significantly expand our knowledge of landscape-level biogeography. As a result, they are singularly important to the study of regional and continental biodiversity. Digitizing these collections will expand accessibility to their holdings, enhance the impact of the data they generate, and ensure incorporation of these data in ongoing biological and paleobiological research. This session will highlight the work of iDigBio, the North American Network of Small Herbaria (NANSH), the NANSH Working Group, and the newly established Small Collections Network (SCNet). Preliminary results from a recent survey, information about an upcoming Small Collection Symposium at SPNHC 2014 in Cardiff, Wales, and a small herbarium digitization workshop to be held in conjunction with Botany 2014 in Boise, ID will also be included

¹ Central Michigan University, Mt. Pleasant, MI; ² Florida State University, Gainesville, FL

206 • Peter Schafran, Joe Keenan, Marcus Jones, Jay Bolin, Lytton Musselman

Germination and Development of Hazel Dodder Cuscuta coryli (Convolvulaceae)

Hazel dodder is one of the rarest native *Cuscuta* species in the Southeast and little is known of its floral and germination biology. It is readily distinguished from other dodder species by its 4- merous flowers and papillate surface. The only other species with a papillate surface is *C. indecora*, a species with 5-merous flowers and found chiefly in coastal marshes. Seeds of *C. coryli* were collected in Rowan County, North Carolina from *Solidago* and *Aster* hosts, cleaned, and scarified using sand paper, then germinated on sand in petri plates in the dark at 20.5 degrees Celsius. Over twenty days the scarified seeds germinated at a rate of 23.5%. Dodder germination yields a hook-shaped epicotyl.

Following our standard protocol for the establishment and growth of *Cuscuta*, germinating seeds were placed on *Solenostemon scutellarioides* (L.) Codd. (Lamiaceae);(=*Coleus blumei* Benth.) by hooking the epicotyl over the distal end of the petiole. The seedling continued to elongate and wrap around the stem. Haustoria typically penetrated the host plant within five to seven days. As soon as parasitic attachment was established, a noticeable swelling of the coil was evident. Germination and establishment of *C. coryli* is similar to all other species in subgenus *Grammica* that we have studied.

Old Dominion University

207 • Krystal T. Payne, Emily L. Gillespie

Using Herbarium Informatics to Revise County Based Distributions of the Ericaceae (Heather) Family Throughout West Virginia

The Ericaceae (heather) family of vascular plants is of great ecological and economic importance in forest ecosystems of the Appalachian Mountains, including agricultural and horticultural cultivars. Data had been previously collected from several large herbaria to establish the known range of native species of West Virginia based on locality (Harmon et al., 2006), with the exception of the Marshall University Herbaria (MUHW), which largely was not included in this effort. The Marshall University Herbarium (MUHW) is the second largest herbarium in the state of West Virginia and contains over 50,000 specimens. The goal of the current study was to use herbarium informatics to compare and contrast known county level distributions of the Ericaceae family that were recorded in the Checklist and Atlas of the Vascular Flora of West Virginia (Harmon et al. 2006) to data provided by the specimens in the Marshall University Herbarium. Several species were found to have sharply contrasting distributions from those previously noted, including several species of Rhododendron and Vaccinium. These apparent new distributions may be an artifact of the lack of documentation in larger herbaria. By updating and utilizing herbarium databases a baseline of reliable data can be established and used for biodiversity studies. Updates in these distributions may lead researchers to develop a clearer understanding of the ecology of ericaceous species, as well as their response to anthropogenic activity.

Marshall University Herbarium (MUHW), Dept of Biological Sciences, Marshall University, Huntington, WV

208 • Herrick H. K. Brown¹, Kate F. Boyd², Henry M. Fulmer³

A Bicentennial Observation of Henry William Ravenel 1814-2014

Henry William Ravenel (1814-1887), a 19th century botanist and mycologist, amassed a remarkable personal herbarium composed chiefly of vascular plants and fleshy fungi, mostly from his native South Carolina. Through international correspondence and exchange, however, his collections boast a significant cosmopolitan element as well. While some specimens obtained through exchange predate his own birth, other collections as well as correspondence from his children indicate that he was actively collecting up until his passing. The breadth of his collections matches his interests, which stretched beyond systematics to related disciplines such as economic botany, public health, and ecology. These related pursuits are reflected through the presence of vouchered agricultural specimens within his herbarium, and are also evident in his own words. Through the latter half of his life, Ravenel kept a detailed journal in which he revealed not only his thoughts on the major defining event of his lifetime, the American Civil War, but also his observations as a scientist and naturalist. His life's work was fragmented posthumously contrary to his desire for it to remain a single entity. While large portions of the collection remain relatively complete and stable, others have been further disbanded or lost forever. Interdisciplinary collaboration and renewed interest in the research potential of these historic specimens has resulted in a better understanding of the status and distribution of Ravenel's collections. Currently proposed projects include the 're-unification' of these disarticulated elements in an online environment aimed at facilitating and extending the reach of continued research.

¹ A. C. Moore Herbarium (USCH), University of South Carolina, Columbia, SC; ² Ernest F.

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Hollings Special Collections Library, University of South Carolina, Columbia, SC; ³ South Caroliniana Library, University of South Carolina, Columbia, SC

209 · Herrick H. K. Brown

Henry William Ravenel: Exchanges, Expeditions, Extirpation and Extinction

The botanical collections of Henry William Ravenel document the breadth of 19th century scientific collaboration through exchange of herbarium specimens. His network of correspondents supplied him with material for comparison and annotation. Well known and respected by colleagues, he was called upon to conduct floristic surveys and collect material for the USDA and the American Museum of Natural History. This commissioned work demanded travel through Texas, Washington, D.C. and Georgia. Along the way, he searched for, but did not find *Franklinia alatamaha*. His failure in locating this 'lost' species bears little testament to his abilities to discover scarce species as he was quite possibly the first and only person to observe *Elliottia racemosa* and *Eriocaulon ravenelii* in the state of South Carolina.

A. C. Moore Herbarium (USCH), University of South Carolina, Columbia, SC

210 • Jennifer Myer, Lori L. McGrew

The Effect of Chronic Exposure to Different Concentrations of Lexapro on Long-Term Memory in Adult Zebrafish (*Danio rerio*)

In a report by the National Center for Health Statistics in 2011, eleven percent of American's aged twelve and over were prescribed antidepressant medication. The most commonly prescribed class of antidepressants is selective serotonin reuptake inhibitors or SSRIs. Serotonin (5-HT) is an important neurotransmitter and neuromodulator in the central nervous system of vertebrates. This study attempted to determine whether exposure to higher concentrations of Lexapro, a common SSRI, resulted in impairment of long term memory in adult zebrafish. Four groups of zebrafish were exposed to Lexapro for three consecutive days, each group at a different concentration. Using a T-maze, the fish were conditioned to choose a favorable arm in the maze. Long-term memory was assessed 10 days post conditioning by testing the zebrafish for the conditioned response. Data was collectedand analyzed using Ethovision software. Data analysis showed no statistically significant evidence to support higher concentrations of Lexapro has an affect on long-term memory.

Dept of Biology, Belmont University, Nashville, TN

211 • Allison McCoy, Lori L. McGrew

The Effects of Chronic Exposure of Celexa (Citalopram Hydrobromide) on Behavior and Memory of Danio rerio

Serotonin is an important neurotransmitter in the brain responsible for the regulation of both motor and cognitive functions. Previous research suggests that too much serotonin in the synaptic cleft can induce certain behaviors in animals. Often these behaviors are anxiolytic in nature, and are easily observed in model organisms such as zebrafish. Additionally, adult zebrafish have shown the ability to learn and demonstrate memory when placed in a common paradigm, the T-maze, an accepted means of testing memory in animal models. Our team wanted to determine if chronic exposure to Celexa (citalogram hydrobromide), a common SSRI, had an effect on the working and long term memory of zebrafish, and whether or not the anxiolytic effects of the drug were obvious through the behaviors of the fish. After a five day treatment period, control and experimental groups were evaluated using the T-maze and given either a positive or a negative consequence based on the decision that was made (choosing right or left). After a two-week rest period, the fish were assessed again and we found an increase of drug concentration caused a decrease in total correct decision making, possibly suggesting the drug had a negative effect on memory. Additionally, the fish were slower to make an initial decision, suggesting the long-term low concentration exposure of Celexa did have an anxiolytic effect on the treated fish. Future research in this area might give researchers a better understanding of the long-term consequences of serotonin exposure, and the possible implications for humans.

Dept of Biology, Belmont University, Nashville, TN

212 • Fakhry M. Daowd¹, Robery T. Grammer²

Investigating the Attraction of Caenorhabditis elegans to Bacillus thuringiensis Through Volatile Organic Compounds

In this study we aimed to investigate the mechanism by which *Bacillus thuringiensis*, a known *Caenorhabditis elegans* pathogen, attracts the worm. We hypothesized that *B. thuringiensis* produces volatile organic compounds that attract the worm. We hoped to identify these compounds by extracting them from *B. thuringiensis* using methanol and attempted to identify them using gas chromatographic and mass spectroscopic analysis. Results showed that in a chemotaxis assay a methanol extract from *B. thuringiensis* does indeed attract the worms. Increasing the concentration of extract by ten-fold showed an increase in attraction, given by an increase in mean chemotaxis index of 0.191 to 0.416, a statistically significant increase. Upon analyzing the extract using gas chromatography there were reproducible traces of volatile compounds in multiple methanol extracts.

¹ Dept of Biology, Belmont University, Nashville, TN.

213 • KelviNeisha L. Williams¹, Timothy Odom¹, Teodora Best², Nicole Zembower², Ketia Shumaker¹, John Carlson²

Comparative Analysis of Ozone Effects and Genomic Expression of Two Hardwood Trees

The goal of this study was a comparative analysis of ozone effects on two species of hardwood trees: Liriodendron tulipifera, L. (Tulip poplar) and Nyssa sylvatica, Marsh. (Black gum). The two species were exposed to four levels of ozone that best represented a conceivable spectrum of exposure (10, 80, 125, 225 ppb). In terms of foliar injury, Tulip poplar was more sensitive to the ozone effects than Black gum. From a comparative analysis of the transcriptoms of the two species, results are expected to show that the Black gum tree is more equipped to handle ozone stress than the Tulip poplar.

¹ The University of West Alabama; ² Pennsylvania State University

214 • Sasha Gogoli, Renee J. Chosed

Modeling the MLL (Mixed-Lineage Leukemia) Complex in Saccharomyces Cerevisiae

Both yeast and humans have highly conservative SET domain containing methyltransferases that are part of large multi-protein complexes. These protein complexes are responsible for the methylation of Histone H3 on the fourth lysine residue (H3K4). This methylation allows for the regulation of HOX genes that initiate the growth of hematopoietic precursor cells from stem cells. Human MLL1 and Saccharomyces cerevisiae Set1 are the methyltransferase enzymes within these protein complexes, which are also composed of several other proteins. The non-catalytic accessory proteins of each complex are thought to play a role in regulating the methyltransferase activity of each complex, yet their roles are not well defined. Saccharomyces cerevisiae contain a single protein complex referred to as COMPASS that is homologous to that of the MLL1 protein complex in mammalian cells. To elucidate the roles of the accessory proteins in the mammalian MLL1 complex, we replaced proteins of COMPASS in yeast with those of the mammalian MLL1 complex. We then assayed for the activity of the protein complex by detecting histone H3K4 methylation by Western blotting. The results of our experiments showed that Set1 and Bre2 are both necessary for the proper function of COMPASS. Replacement of yeast Set1 with its human homologue MLL1, led to a partial rescue of the observed H3K4 methylation deficiency. Studies are ongoing to recover methylation by introduction of Ash2L into the yeast strain deficient in Bre2.

Dept of Biology, Furman University, Greenville, SC

215 • Jacob Hanna, Renee J. Chosed

Ruthenium Complex KP1019 and Its Effects on Saccharomyces cerevisiae

The anticancer ruthenium complex *trans*-[tetrachlorobis(1*H*-indazole)ruthenate(III)], also known as KP1019, has been previously shown to induce DNA damage and cell death consistent with the formation of DNA Interstrand cross-linkage. These conclusions were based off of the analysis of the hypersensitivity of yeast strains defective in DNA to treatment with KP1019. However, DNA interstrand cross-linkage does not explain KP1019's ability to retain its toxicity against cancer cells resistant to such DNA damage. This suggests that addition KP1019 possesses additional cytotoxicity factors. Using *Saccharomyces cerevisiae* as a model organism we examined the alterations in histone modifications following treatment with KP1019. We utilized W303a, Δ*pdr1*, and Δ*pdr3* S. *cerevisiae* strains. We found noticeable variation in multiple histone modifications including H3K4 tri-methylation and H4 acetylation. These data suggest that KP1019 may alter histone post-translational modifications in addition to forming DNA adducts.

Dept of Biology, Furman University, Greenville, SC

216 • Rebekah L. Robinson¹, Claudia Y. Alvarado¹, Mario Johnson¹, Scott C. Mateer¹, Ron E. Garner², Traci L. Ness¹

Construction of a Single Nucleotide Polymorphism in the Human TLR4 Gene

Pattern recognition receptors (PRRs) are responsible for recognizing pathogens and initiating appropriate immune responses in many cell types. Toll-like receptor four (TLR4), a well-studied PRR, is the receptor for lipopolysaccharide (LPS) found in the outer membrane of Gram-negative bacteria. However, it has been demonstrated that the fungal polysaccharide mannan is also capable of binding and signaling through TLR4, but the details of this interaction are poorly understood. TLR4-D299G is a naturally-occurring polymorphism which has been shown to alter the response to LPS. Individuals with this polymorphism are highly susceptible to Gram-negative bacterial infections. Our lab is interested in determining if this polymorphism will also eliminate mannan binding and signaling through TLR4 in human cells. The goal of this project was to construct the TLR4-D299G polymorphism in the plasmid pUNO-hTLR04a using circular mutagenesis. A single nucleotide change (adenine → guanine) was introduced which changed the amino acid at site 299 from an aspartic acid (D) to a glycine (G) residue. The success of our mutagenesis strategy has been verified by antibiotic resistance of bacterial transformants, Pst I digestion of the isolated plasmids, and direct sequencing of the plasmid. Future studies will include transfection of the TLR4-D299G plasmid into a reporter cell line to test mannan's ability to bind and activate this polymorphic form of the TLR4 receptor.

¹ Dept of Biology, Armstrong Atlantic State University, Savannah, Georgia; ² Mercer University School of Medicine, Savannah, Georgia

217 • D'angeleau Newsome, Nick Ragsdale

Investigating the Role of Hif-1 in Resisting Infection by Staphylococcus aureus in Caenorhabditis elegans

The hypoxia inducible factor (HIF-1) is a transcription factor that during hypoxia sets in motion a genetic cascade that decreases metabolism and ultimately results in increased longevity in the wild type *Caenorhabditis elegans*. (Lee *et al.*, 2010). HIF-1's affect on longevity in *Caenorhabditis elegans* may also affect the nematode's ability to resist bacterial infection. To test the resistance to infection by *Staphylococcus aureus*, wild type *Caenorhabditis elegans* were examined and compared to resistance in the *Hif-1* knockout and *la-7* over-expressor. The *Hif-1* mutant strain is not capable of producing HIF-1and therefore does not have the ability to activate the longevity response in low oxygen environments. The *la-7* mutant over-expresses the HIF-1 by preventing protein degradation.

Belmont University

218 • Taylor Brown, Nick Ragsdale

Measurement of Adenine Nucleotides in Caenorhabditis elegans With and Without Staphylococcus aureus Infection

Organisms use Adenosine Triphosphate, or ATP, as a source of energy from catabolic reactions in order to perform daily activities. ATP levels can be representative of the metabolic response as a whole. This information may be useful when studying the effects of infection. Evidence suggests that infected organisms have marked alterations in metabolic activity. By examining ATP levels in *Caenorhabditis elegans* nematodes in both non-infected and *Staphylococcus aureus*-infected nematodes, metabolic responses can be assumed. If the metabolic response of an infected organism differs from a non-infected organism, it can be presumed that metabolism has been altered during infection. We hypothesize that infected nematodes will have a higher reading of adenosine nucleotides, because metabolic levels will be spiked to fight the infection. If true, with this information, future replacement therapies can be developed targeting different metabolic pathways, ultimately resulting in a better outcome from infection or even immunity from a pathogen.

Belmont University

219 • Justin Hughes, Nick Ragsdale

Potentially Protective Effect of Caffeine in Caenorhabditis elegans Treated With 6-Hydroxydopamine

Dopamine nerve loss is understood to be the primary cause of Parkinson's disease, and the current treatments for Parkinson's disease have many negative side effects. The model organism *Caenorhabditis elegans* has long been a model organism to study the disease. When looking at Parkinson's disease in other mammals such as rats, caffeine has been shown to have a neuroprotective effect on the loss of the dopaminergic nerves. Further, caffeine has been shown to be an antagonist to the adenosine receptor A_{2A} , which is believed to play a key role in the degradation of dopamine nerves. Lastly the following research examined the neuroprotective effects of caffeine on *C. elegans* treated with neurodegenerative chemical 6-OHDA. The results of the research may lead to a better treatment and possible prevention to the onset of Parkinson's disease.

Belmont University

220 • Simone M. Dixon, Victoria L. Turgeon

Relative Gene Expression of Protease-Activated Receptor-1 (PAR-1) Mrna in Rat Schwann Cells Following Receptor Activation

Protease Activated Receptor-1 (PAR-1) is a G-protein coupled receptor activated by the serine protease thrombin. In the nervous system, activation of PAR-1 induces apoptosis of avian spinal motor neurons during the period of programmed cell death and reduces outgrowth of neurites. The PAR-1 receptor is also localized on oligodendrocytes and Schwann cells near the node of Ranvier. We localized the PAR-1 receptor to the surface of rat Schwann cells using immunocytochemistry and confirmed gene expression with qRT-PCR (quantitative real-time reverse transcription PCR) studies. To determine if PAR-1 receptor mRNA is regulated by a feedback mechanism after initial activation. Schwann cells were treated with 100 nM of the synthetic peptide SFLLRNP to activate PAR-1, and gRT-PCR was conducted at 0, 4, 8, and 12 hours following PAR-1 activation. There was no up- or down- regulation of PAR-1 receptor mRNA after activation at any of the time points, indicating constitutive expression of PAR-1 mRNA. However, these results do not address the specific localization of the receptor to the surface of the plasma membrane. Given that surface expression of PAR-1 is regulated by feedback mechanisms in other cell types, future investigation of PAR-1 localization is warranted. If PAR-1 surface expression is changed following activation, responsiveness of cells to thrombin may be altered, disrupting the normal balance of PAR-1 signaling in the nervous system and contributing to disease states.

Dept of Biology, Furman University, Greenville, SC

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221 • Maria Martino, Nick Ragsdale

Role of Beta Oxidation in the Immunological Response to Staphylococcus aureus in Caenorhabditis elegans

The rate of obesity in the United States is extremely high and continues to grow. Many studies have been conducted linking obesity to certain diseases, however less is known about obesity's effect on the immune system. The *Caenorhabditis elegans* worm will be used in this study to explore the effects of obesity on immune function. The vast amount of identified immune and metabolism pathways of the *C. elegans* make it an excellent candidate for this exploration of the effect of obesity on immune function. Mutations in the *tub-1* gene in the *C. elegans* have been determined to increase fat deposition and mimic what is seen in obese humans. Both *Tub-1* mutant *C. elegans* worms and wild types will be exposed to the bacterium, *Staphylococcus aureus* which is known to decrease lifespan. The death rates of these groups will be compared to the death rates of both *Tub-1* mutant and wild type *C. elegans* worms not exposed to the bacterium.

Belmont University

P1 • Riley Z. Tunnell1, David A. Johnson2

Non-Specialized Herbivory in Megacopta cribraria Adults and Its Possible Implications

Megacopta cribraria (the bean plataspid or kudzu bug) is an invasive herbivorous plataspid that was introduced to the United States in 2009 and has subsequently spread across the southeastern USA. It was thought to feed primarily on *Pueraria montana* (kudzu), *Glycine max* (soybean), and a few other legumes. We extracted DNA from adult *M. cribraria* viscera, PCR-amplified, then sequenced an exon of the chloroplast trnL gene. Our results indicate that *M. cribraria* adults are not only feeding on *P. montana* and other legumes, but also on a variety of angiosperms and some conifers. It is proposed that this much broader diet and a possible non-kudzu preference in adults could be partially responsible for the bug's rapid spread, and could also mean that *M. cribraria* is a more threatening pest than was previously thought.

¹ Judson College, Marion, AL; ² Samford University, Birmingham, AL

P2 • Stephen J. Zumdick, Richard S. Phillips, Alec VanDyke

Resource Partitioning Between Phenotypes of Peromyscus in Ohio

Peromyscus is a vast that genus whose species cover much of the United States. It is not uncommon to see two Peromyscus species coexisting in the same habitat. The question for this study was how do two Peromyscus species use resource partitioning to allow both species to coexist on a plot of land in Clark County, Ohio. We used data from mark recapture studies collected over three years from three states: 2010, 2011, and 2012 and Michigan, Ohio, and Mississippi. The purpose of the data collected in Michigan and Mississippi is to use tail to body length ratios to accurately distinguish between species. The Ohio data was used to determine the frequency of capture, used to infer resource partitioning, between species and its correlation to seasons: spring, summer, and fall. If one species is more active during one season its chance of being captured will increase compared a species that is less active during that same month. We predict phenotypes will separate by habitat or time.

Wittenberg University Dept of Biology

P3 • E. Natasha Vanderhoff, Jennifer Brehm

Preliminary Investigation of Camphor Seed Dispersal: The Role of American Robins

Fruit is an important resource for migrating and wintering birds and many non-native fruits are becoming an important part of these birds' diets. The camphor tree *Cinnamonum camphora* is native to Asia and was initially introduced to Florida in 1875. The camphor tree produces dark fleshy fruit with a single large seed from late-September until January, a peak time for migrating and wintering birds in Florida. We surveyed the Jacksonville University campus for camphor trees and selected five trees to measure fruit production

from October until January. Additionally, we gathered data on birds foraging in camphor trees to estimate fruit removal and seed disperser potential. A single camphor tree can produce over a thousand fruit; however flocks of migrating birds, like the American Robin *Turdus migratorius*, can remove most of the fruit within several weeks. Our investigation is preliminary and in the future we hope to discern the role of migrating flocks in the spread of the invasive camphor tree.

Dept of Biology & Marine Science, Jacksonville University, Jacksonville FL

P4 • Maxwell R. Cox, Emma V. Willcox

Bat Community and Habitat Response to Prescribed Fire and Canopy Reduction in Tennessee Hardwood Forests

The use of prescribed fire, in conjunction with canopy reduction treatments, has the potential to dramatically alter habitat conditions for bats in southeastern hardwood forests. In this region, many bat species imperiled by White Nose Syndrome (WNS, Pseudogymnoascus destructans) are forest-dwelling, utilizing hardwood forest systems for foraging, particularly during critical pre/post-hibernation and maternity periods. Therefore, managing hardwood forests to provide high quality foraging habitat may be critical for population persistence and species recovery. This is especially true in the forested regions of the southeast in close proximity to major cave hibernacula infected with WNS. Prescribed fire and canopy reduction in this region may benefit foraging habitat for many bat species by improving stand structure and increasing insect prey availability. We are evaluating the effects of 2 prescribed burn treatments (growing- and dormant-season) in conjunction with 2 canopy reduction treatments (low and high) on the foraging habitat and ecology of a suite of bat species. We are conducting our study on >20 replicated treatment stands on 2 study areas in Tennessee hardwood forest. Our objectives are to examine 1) the impact of prescribed fire and canopy reduction on a) hardwood forest structure and composition, b) abundance and biomass of nocturnal flying insects, and c) bat activity, species richness, and site occupancy; and 2) the relative contributions of nocturnal flying insect prey availability and forest structure in explaining bat activity, species richness, and site occupancy. We will present initial bat activity and species richness results from the first year of our study.

Dept of Forestry, Wildlife, and Fisheries, University of Tennessee, Knoxville, TN

P5 • Elizabeth C. Ray, Matthew J. Heard

Effects of Forest Succession on Land Snails of South Carolina

Urbanization is increasing worldwide and land conversion for human needs is reducing the amount of microhabitats in which many species can persist. One type of organism that relies on the existence of microhabitats is the land snail. Land snails are extremely diverse and tremendously understudied. However, these taxa may be an indicator of the health of a local environment. In this study, we measured how land snail diversity varied across a 25-year successional gradient (in 3 plots aged 15, 20, and 25 years) to examine the impact of land use change in South Carolina. We collected snails in two ways: 1) through a timed visual search for macrosnails and 2) by collecting soil samples for microsnails. We then compared generic diversity and turnover across successional plots using both the Shannon-Weiner Diversity Index and the Jaccard Similarity Index. Using these analyses, we found that diversity was highest in the intermediate aged plot (H=1.189). In addition, we also determined that there was significant turnover of taxa between plots (average generic similarity between plots was 58%). Collectively, our data indicate that the process of succession can impact snail diversity. However, more research is needed to fully understand the impact of land use on terrestrial snails.

Dept of Biology, Winthrop University, Rock Hill, SC

P6 · Sarah Rawlins, Ann M. Stoeckmann

Changes in Community Structure of Two Exotic Invasive Bivalves in Lake Erie

The invasive mussels, Zebra (Dreissena polymorpha) and Quagga (Dreissena bugensis), have had devastating economic and ecological impacts. In addition, Quaggas are replacing zebra mussels as the dominant species in western basin of Lake Erie. This experiment tracked population characteristics (density, species proportions, sizefrequency). We also measured the effects of predation on mussels' population by an invasive fish (Round Goby). Gobys eat smaller, newly settled mussels. If predation is changing mussel populations then in subsequent years, the number of young mussel offspring in the ecosystem should decrease. To determine if population characteristics of mussels have changed, benthic samples were collected from rocks (2008 and 2010). To test the effects of predation by the Goby, lines holding settlement plates (3 x 5 cm²) protected by cages were suspended 2 meters above the bottom by a buoy (May-August 2010). Species were separated and shell lengths were measured. Preliminary results show that density has declined and Quaggas were the dominant species in 2008 making up 71% of the benthic population and 62% of the settlers and 81% and 65%, respectively, in 2010. Gobies appear to be limiting mussel recruitment thereby reducing the impact these mussels have on the ecosystem.

Dept of Biology, Francis Marion University, Florence, SC

P7 • Benjamin E. Hardie, F. Whitner Chase, Maximilian M. Kern, Leigh Anne Harden, Shannon E. Pittman, Michael E. Dorcas

Evaluation of Individual Identification Methods for Spotted Salamanders (Ambystoma maculatum)

Capture-mark-recapture studies are valuable to conservation decision-making as they allow for the evaluation of demographic parameters of a population. In capture-markrecapture studies, spotted salamanders (Ambystoma maculatum) are often marked with visible implant elastomers (VIEs), allowing for individual salamanders to be identified upon recapture. However, this elastomer coding system is expensive, invasive, and offers a finite number of codes, making it unsuitable for a long-term study. Thus, we have developed a new coding system that identifies spotted salamanders based on individuals' unique spot patterns. In this study, we compared the two coding systems to determine the effects of both identification method and observer on identification accuracy. Over one breeding season we monitored A. maculatum entering and leaving a 0.5 ha ephemeral wetland in the North Carolina Piedmont using 40 aquatic funnel traps and a 400 m drift fence with pitfall traps at 10 m intervals completely encircling the wetland. Several Davidson College Herpetology Laboratory students blindly identified each individual A. maculatum using both spot pattern codes and VIE codes (if previously marked). Photographs were also taken of each individual for verification of spot pattern codes when recaptured. Identification accuracy was compared among observers, between coding systems, and among captures. Our study provides recommendations for use of an identification system using spot pattern allowing it to be implemented in long-term studies of A. maculatum and potentially adapted for use in other species.

Dept of Biology, Davidson College, Davidson, NC

P8 • Grayam R. Sailor-Tynes, Maximilan M. Kern, Michal E. Dorcas

Natural History of Eastern Box Turtles (*Terrapene carolina carolina*) in North Carolina: A Study Based on Citizen Science

An extensive study of eastern box turtles (*Terrapene carolina carolina*) throughout North Carolina was conducted by the Davidson College Herpetology Laboratory and trained citizen scientists working through the Box Turtle Connection. Turtles were captured opportunistically and were measured and individually marked. Analysis of measurements yielded capture data, body condition indices, instances of injury and recapture as well as

seasonal capture rates. A total of 2,424 turtles were captured and 597 instances of recapture were documented. More adults and more males than females were captured overall. Body condition varied across seasons and ecoregions and along with capture frequency suggested substantial variation for turtles in different ecoregions. Instances of injury ranged from 5.7% to 29% throughout the state. Results of this study suggest that citizen science can be extremely useful when studying species such as the box turtle that are difficult to sample consistently, and can provide crucial information for conservation efforts.

Dept of Biology, Davidson College, Davidson, NC

P9 • Beau B. Gregory¹, John O. Whitaker, Jr.², Gregory D. Hartman³

Diet of Rafinesque's Big-Eared Bat (Corynorhinus rafinesquii) in West-Central Louisiana

We investigated diet of Rafinesque's big-eared bats, *Corynorhinus rafinesquii*, in west-central Louisiana by examining fecal pellets collected from beneath three bridges that were used as day roosts. Fresh fecal material was found under the bridges during every month of the year. Five insect orders, including five families, were detected in fecal pellets collected from 25 August 2005 to 5 January 2007. Lepidoptera represented 93.8% of the total volume and was the only order observed in 100% of our samples. Coleopterans, mostly Scarabaeidae, were the next most abundant food item and represented 5.8% of the total volume. Hemiptera, Diptera, and Hymenoptera together represented 0.4 % of the total volume. Diptera, Hemiptera, Hymenoptera, and scarabaeid Coleoptera were observed in fecal pellets collected under some, but not all three of the bridges. No insect orders were observed that previously had not been reported as prey of Rafinesque's bigeared bats. Our results were similar to those reported in studies conducted in Kentucky, North Carolina, and Florida, and we concluded that Rafinesque's bigeared bats primarily prey upon lepidopterans, and do so throughout the year in west-central Louisiana.

¹ Louisiana Natural Heritage Program, Louisiana Dept of Wildlife and Fisheries, Lake Charles, LA; ² Dept of Biology, Indiana State University, Terre Haute, IN; ³ Dept of Biology, Gordon State College, Barnesville, GA

P10 • Morgan Soulantikas, Jeff Steinmetz, Paul Zwiers, Travis Knowles

Bioacoustic Monitoring of American Crow (Corvus brachyrhynchos) Activity Patterns on the Campus of Francis Marion University

The American Crow (Corvus brachyrhynchos) is a medium-sized, stocky, black, perching bird of the Crovidae family. American crows mainly reside in woodland, farmland, and suburban areas. They require open spaces for ground feeding, but scattered trees, woodlots, and forest edges must be present in order for the birds to have a safe place to nest and roost. The campus of Francis Marion University provides sufficient habitit in which American Crows can thrive. In this study, bioacoustic monitoring equipment was used to collect data on the population of American Crows living in the campus area during the months of August through March. A double-microphone recording unit was placed in several wooded regions across FMU's campus for the span of three to five days at a time. the device recorded any sound ans tored it as a file to a memory card. These files were then analyzed by using SongScope Bioacoustic Software where audial activity could be easily identified and used to determine teh exact hours throughout the day when the birds are most active. Preliminary data suggests that the population of American Crows residing the area is most active and produce the highest number of vocalizations during the hours of 7:00 a.m. to 10:00 a.m. and 12:00 p.m. to 3:00 p.m. Future analysis will examine weather related and seasonal changes in activity and calling frequency.

Biology Dept, Francis Marion University, Florence, SC

P11 • Joseph M. Morrissey, Samantha L. Poarch, Jonathan J. Storm

Abundance of Carnivorous Mammals in Urban Greenways and Rural Forests

Small mammals often face a high risk of predation from two sources in urban environments, native predators and feral or domestic cats (*Felis silvestris*). Native

predators in these urban forests include gray foxes (*Urocyon cinereoargenteus*), red foxes (*Vulpes vulpes*), and coyotes (*Canis latrans*). Our previous work has suggested that white-footed mice face a greater risk of predation within urban greenways than in rural forests of Spartanburg County. We used wildlife cameras to determine whether carnivorous mammals are more abundant within urban greenways than in rural forests. The cameras were placed within riparian forest habitat at 3 urban greenways within the city of Spartanburg, South Carolina, as well as 3 riparian forests in rural Spartanburg County. During June - August of 2013, the cameras were baited with a 1:1 mixture of catnip oil and canola oil. The cameras were then left unbaited for September - December of 2013. Our results suggest that gray foxes, red foxes, and raccoons (*Procyon lotor*) are more prevalent within urban forests, while white-tailed deer (*Odocoileus virginianus*) are more prevalent within rural forests. At all study sites, feral and domestic cats were rare. Our results suggest that small mammals within both urban greenways and rural forests face a low risk of predation from cats.

Division of Natural Sciences and Engineering; ² University of South Carolina Upstate; ³ Spartanburg, SC

P12 • Lauren K. Childress, Lisa M. Krueger

Storage Effects on Pine Rockland Grass Seed Viability and Germination

Pine rocklands are an endangered ecosystem in south Florida, and are rapidly declining largely due to fire suppression, development, and invasive species. A recent study suggested that mechanical scraping combined with native seed sowing had the greatest potential to be successful in restoring native grasses to a disturbed pine rockland. However, little is known concerning the effects of storage on native seeds that may be used in such restoration plantings. Our goal was to see what effects storage had on the germination of several pine rockland grass species, and determine which species would be ideal for future restoration efforts. We collected seeds of eight species from four pine rockland preserves in Miami, Florida in October 2013. Seeds were grown in a growth chamber in 24 hours of light per day at 30°C on petri dishes filled with saturated sand to determine the total percentage of seeds that germinated for each species. We examined germination for seeds subjected to two treatments, freshly collected (fresh) and three months of storage at 4.9°C (cold-stored). Species significantly differed in the total number of fresh seeds that germinated. Andropogon ternarius and Schizachyrium gracile had the highest percentage of germinated seeds (66% and 39% respectively), suggesting these species would be optimal for use in restoration projects. Preliminary results show two species (Eustacys petraea and Aristida purpurascens) had a significantly higher number of germinated cold-stored seeds than fresh seeds after the first eleven days of the trial. Further observation will determine if this difference will be maintained.

Biological Sciences, University of Tennessee at Martin, Martin, TN

P13 • Abigail E. Gwinn, Douglas A. Rayner

Invasive Epigeic Earthworms Implicated in the Decline of the Endangered Sisyrinchium dichotomum (Iridaceae)

The Chestnut Ridge population of Sisyrinchium dichotomum in South Carolina has experienced a drastic decline in population count since 1998. Invasive epigeic earthworms have made an appearance in recent years; they are known to alter plant community composition by changing soil structure, depleting the humus layer, and selectively removing seeds from the seed bank through ingestion and digestion. In the lab, we conducted a pilot study of the ingestion/digestion of S. dichotomum seeds by the epigeic earthworms found at the site. In the field, we determined soil depth associated with each plant and made observations on plant condition, presence of a humus layer, and presence of worm castings. Epigeic earthworms ingested and digested significantly more S. dichotomum seeds than the anecic nightcrawler, Lumbricus terrestris. However, the epigeic worms liquefied within two days of ingestion, pointing to potential toxic effects of S. dichotomum seeds. We found a significant correlation between plant condition and soil

depth. Plants in good condition were found in deeper soils than plants in poor condition. The humus layer was thin to absent around all plants and worm castings were ubiquitous. The depletion of the humus layer is especially important on south-facing slopes, the preferred habitat of *S. dichotomum* throughout its range. Experiments are planned that test the hypothesis that epigeic earthworms, via their rapid consumption of humus, negatively affect seed germination and seedling establishment, as well as plant condition.

Dept of Biology, Wofford College, Spartanburg, SC

P14 • Maitlyn E. Mullen, Jessica L. Fleming, Lawrence J. Davenport, Kristin A. Bakkegard, Elizabeth G. Dobbins

Revegetation of an Urban Riparian Zone: Species Richness and Population Dynamics

The analysis of revegetation efforts requires consideration of both planted and volunteer species. This study was conducted to measure the current species richness of native and invasive species from the 2011 revegetation of 160 meters on the south bank of Shades Creek in Jefferson County, Alabama. We predicted that there would be a greater number of invasive species than native species established by either seed, seedling or tree planting in 2011. In the restored site, we found a higher species richness and average percent cover for invasive species than native species and a lower percent survival for those native species planted in 2011. Only 6 out of the original 47 native species planted in 2011 survived. In the 2 control sites, we had 2 zones: riparian and upper bank. In the control zones, invasive species had higher species richness and average percent cover, except in the riparian zone of the second control. Richness and average percent cover in the controls was less than in the revegetated site. Recolonization of native species is still occurring in the revegetated site, but the majority of native species present are not those that were planted in 2011. In the future, restoration efforts should not focus on extensive planting of native species, but should concentrate on supporting natural self-restoration through better removal techniques to prevent the reinvasion and spreading of invasive

Dept of Biological and Environmental Sciences, Samford University, Birmingham, AL

P15 • Zachary Masters¹, Kunsiri Chaw Grubbs²

The Potential Pollinators of Schweinitz Sunflower (Helianthus schweinitzii), Asteraceae

(Helianthus schweinitzii) as an endangered species. Native populations are found in the Piedmont of the Carolinas. In Fall 2013, populations located in the Winthrop Recreation & Research Complex and Blackjacks Heritage Preserve were observed to identify pollinators of this sunflower. Potential pollinators include insects from the orders Hymenoptera, Diptera, and Coleoptera. The Eastern carpenter bee (*Xylocopa virginica*) appears to be one of the most important pollinators. However, many other insects appear on the inflorescences often enough to be considered intentional or unintentional pollinators. Further research will focus on the observation of the frequency and time that each pollinator visits the inflorescences.

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P16 • Samuel Watkins, Theron Kantelis, N. Royce Dingley, Patrick Felch, Martin L. Cipollini

The First Tests of Blight-Resistance in Backcross Hybrid American Chestnuts (*Castanea dentata*) in Georgia: An Assessment of Leaf, Stem, and Bud Traits

The American Chestnut Foundation (TACF) uses backcross breeding to create hybrid American chestnuts (*Castanea dentata*) with resistance to blight (*Cryphonectria parasitica*) originating from Chinese chestnut (*Castanea mollissima*) parents. This process successively backcrosses hybrids to American chestnut thereby increasing the proportion of American genes in each generation. At each step, hybrids are selected for blight resistance and for morphological traits fitting an American chestnut phenotype. In 2008, three lines of 3rd backcross (BC3) hybrids were planted at Berry College, Georgia, along

with American, Chinese, and F1 controls. The BC3 lines were the first bred using American chestnuts from Georgia (as part of TACF's state chapter program). Trees were inoculated with blight in June 2013, and level of resistance was assayed in October 2013. At that time, branch samples were collected from all trees and used to evaluate 26 leaf, stem, and bud traits known to differ between American and Chinese chestnuts. With few exceptions, significant differences were found between the traits of Chinese and BC3 lines. A species identity index was derived by averaging standardized scores for all morphological traits, with low scores representing the American phenotype. Comparisons of this index sorted out genetic lines as predicted based upon the degree of American parentage. Several trees within each BC3 line had both good blight resistance and a highly American chestnut phenotype - a result consistent with the goals of TACF's breeding program. Blight resistance will be reassessed in May 2014, and additional phenotypic traits will be considered prior to making final selections.

Dept of Biology, Berry College, Mount Berry, GA.

P17 • Michael J. Bender, Gregory D. Hartman

Bat Activity Increases With Increased Barometric Pressure and Temperature During Autumn in Georgia

Activity patterns of bats are known to vary substantially among nights, seasons, years, and geographic regions but the underlying reasons for those patterns are poorly understood. Our objectives were to assess the temporal variability of acousticallydetermined bat activity during autumn in central Georgia and to evaluate the influence of barometric pressure and nighttime temperature on nightly activity using AICc and regression models. We recorded 134,392 bat calls and 13,753 sequences using an ANABAT SD2 detector during 87 sample nights (11 August - 11 November 2011) at a residence in Barnesville, Georgia. The number of sequences recorded nightly ranged from 3 to 763. On average, activity was consistent throughout the night with a slight peak just before sunrise, but within-night activity patterns varied among nights. Modelling results indicate that nightly bat activity was positively related to average nightly temperature and average nightly barometric pressure. In contrast to our expectations, measures of pressure change prior to or during sample nights were not plausibly related to bat activity. The positive relationship between autumn bat activity, temperature, and barometric pressure likely was related to the energetic costs and benefits associated with flight and prey availability during this season in central Georgia.

Dept of Biology, Gordon State College, Barnesville, GA

P18 • Kelsey B. Ortiz¹, Joshua W. Campbell¹, Matthew N. Waters², Frederick Rich³

A Record of Ecological/Anthropological Change From Bat Guano Deposits in Fern Cave, Jackson County, Alabama

Bat guano can accumulate in caves resulting in a stratigraphic record that may record anthropological/ecological change. Southeastern bats forage for insects and their feces build up beneath their roosting areas, depositing insect remains, pollen, fungal spores, etc. On July 1, 2011 a 104 cm bat guano core was taken from Fern Cave located in Fern Cave National Wildlife Refuge near Paint Rock, Alabama. During the coring process, the guano core compacted to 43 cm. We gathered heavy metal (Mg, Fe, Pb, Zn, Mn, Cu, Cr, Cd, Co, Ni, Al) and nutrient data (C, N, P, Ca), relative pollen counts, and quantified chitin pieces. Based on carbon dates, the core dated AMS ¹⁴C 5920 +/- 40 yr BP. A three cm charcoal layer was discernable between the 26-29 cm layer, which was dated to AMS ¹⁴C 2690 +/- 30 BP. Numerous heavy metals and nutrients exhibited several variations throughout the core. The pollen record within the guano core showed numerous marked changes in potential plant cover of the immediate area. Corn also spiked within the core; probably resulting from Paleo-Indian or early Europeans cultivation of corn. Chitinous exoskeletal pieces were observed up until the charcoal layer. Chitinous material was well preserved within the first 10 cm but began to show signs of diagenesis towards the charcoal layer (26-29 cm). Overall, our bat quano core exhibited many anthropological

and ecological changes throughout time that could be observed through pollen, nutrient/heavy metal data, and chitinous exoskeletal pieces.

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P19 • Brian Schwenk, Dean Cocking

Landscape Heterogeneity of Airborne Hg (Mixed Dissolved, Particulate and Vaporous) and a Sampling of Total Hg Concentration in Macro-Invertebrates Within Rockingham Co., VA

Distribution of Airborne Hg is known to occur at the landscape level. Passive air samplers consisting of inverted plastic Petri plates containing Tangle Trap (a sticky organic) have been used to examine its presence at a variety of locations in Rockingham Co VA. The assumption is that this deposition serves as a relative indexof the different locations in the landscape. The total Hg content when plates were exposed to the air over a fixed period was measured. Five contaminated locations, which had consistently above average Hg concentrations, and a low Hg control site, were selected for more extensive study in 2010-2012. In addition to dust, Hg vapor, and Hg dissolved in precipitation, the Tangle Trap captured various invertebrates and debris. All items greater than ~0.5 mm in diameter were removed for airborne determination. During 2010-2012, separate fly, beetle, wasp, and spider traps were deployed with the intent of obtaining greater invertebrate biomass for analysis. A comparison was made of the relative Hg content of the air dried invertebrate tissue (mostly insects) to the relative airborne Hg measured by the plate samplers. Some invertebrates from the contaminated locations had 2-5 times higher Hg concentrations than those at the low Hg control site. This supports the presence of a repeatable pattern of distribution of low level Hg in a rural, non-industrial landscape. Whether or not this is a result of existing background airborne contamination or due to local sources is to be determined.

Dept of Biology, James Madison University, Harrisonburg, VA

P20 • Walt Thompson¹, Jennie Haskell¹, Doug Aubrey²

Short Term Effects From a Late Season Freeze on White Oak (Quercusa alba L.) Acom Production in the Southeastern Coastal Plain

Since 1995 acorn collections have been made for the hardwood reforestation program maintained by the US Forest Service on the Savannah River Site in South Carolina. On April 8th and 9th, 2007, a late season freeze damaged white oaks and killed the 2007 white oak acorn crop with recorded temperatures of 26°F and 30.5°. This also had an effect on the 2008 acorn crop for white oaks on the southwestern part of the forest. Hard mast production varies yearly and consecutive years of poor mast production affect potential natural and artificial regeneration opportunities and hard mast for wildlife. With changing climate conditions, white oak seed production and natural regeneration may be jeopardized.

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P21 • Marvin E. Brown

Botanical Inventory, Synthesis, and Habitat Modeling of Winyah Bay and the Lower Waccamaw Watershed, Georgetown County, SC

Global warming is believed to be the cause of sea level rise along the Atlantic Coast of South Carolina in excess of 20 centimeters in the last 50 years. Georgetown County is one of six coastal SC counties and contains the third largest estuary on the Atlantic Coast. Rising sea levels may drastically alter coastal habitats and their residing plant communities. Prince George Tract (PGT) is located just south of Pawleys Island, South Carolina along US Hwy 17. A plant survey of PGT will be included with previous floral surveys in the area to constitute a major floristic inventory synthesis. The previous surveys were conducted at The Belle W Baruch Institute, the Tom Yawkey Wildlife Center, Brookgreen Gardens, and Huntington Beach State Park, all of which are within 2 km of tidal saltwater. PGT is in the center, with the Tom Yawkey Wildlife Center roughly 20 km

south and Huntington Beach State Park 16 km to the north. ArcGIS will be used to map habitats and Sea Level Affecting Marshes Model (SLAMM) will be used to determine how these habitats will shift as sea levels rise. The recent discovery of two plant species new to science in this region highlights the importance of developing management techniques based on future ecosystem characteristics.

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P22 • Amanda M. Keasberry¹, Arvind Bhuta², Justin L. Hart¹

Contributions of Macroscopic Charcoal to the Carbon Stock in a Southeastern Longleaf Pine Ecosystem

Longleaf pine stands of the southeastern US are typically maintained with low-intensity surface fires. When a forest fire occurs, carbon dioxide is released and organic carbon is reduced in the atmosphere. Although some amount of carbon is exiting the ecosystem, more is being produced in the form of pyrogenic carbon. Pyrogenic carbon is not readily degradable and can persist in the soil for thousands of years. This charcoal causes terrestrial soil ecosystems to accrue carbon, which accounts for a major portion of total carbon stocks. Forests may provide key contributions to the global carbon stock based on the history of frequent fires, large amounts of woody biomass, and relatively dry site conditions. The objective of this study was to quantify macroscopic (≥ 2 mm diameter) charcoal content in mineral soils to determine its contribution to the total soil carbon stock. These data are lacking in this region, but are required for ecosystem level forest management. Macroscopic charcoal had the lowest percentage by relative mass (0.08%), but contained the highest average carbon concentrations (35.27%) compared to all other soil components. Preliminary results indicate that macroscopic charcoal is an important source of carbon in longleaf pine forests in the region. Gaining knowledge on the role of charcoal in forest systems is necessary for managing forest ecosystems that are prone to fires and can aid in carbon cycling modeling.

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P23 • Thomas A. Weber¹, Justin L. Hart², Callie J. Schweitzer³, Daniel C. Dey⁴

Influence of Gap-Phase Disturbance on Development and Succession in a Southern Appalachian Quercus-Pinus Forest

Quercus-Pinus forests of the eastern US span > 13 million ha. It is important for managers to understand the methods used to sustain Pinus spp. in these mixtures or progress toward a more natural mixture of hardwoods. Understanding developmental and successional patterns in this forest type can help assess the need to actively manage natural processes, or to inform silvicultural prescriptions to achieve management goals. Little research has been conducted on localized disturbance processes in Quercus-Pinus forests. We examined 60 canopy gaps in a Quercus-Pinus forest on the Cumberland Plateau in Alabama to analyze their influence on development and succession. Most canopy gaps (53%) were single treefall events caused by snapped stems. The majority of gap maker trees (56%) were Pinus individuals while 44% were hardwoods. Most gaps (58%) closed by height growth of subcanopy trees. The majority of these gap filler taxa were hardwoods: Quercus (39%), Carya (14%), Pinus (14%), Nyssa Sylvatica (12%), and other (15%). Significant positive relationships existed between gap size and sapling diversity ($r^2 = 0.15$, P = 0.002), tree diversity ($r^2 = 0.21$, P = 0.0002), and total stem diversity (r² = 0.29, P < 0.0001). The number of Pinus gap makers and the number of gaps projected to fill by subcanopy recruitment of hardwoods indicated the forest was in the latter stages of a composition shift from Pinus to a much stronger Quercus component. To maintain a Pinus component, managers would likely need to create canopy gaps larger than those documented here and remove hardwood competition from the regeneration

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P24 • Kody Fox, Rob Hopkins

Understanding the Role of Climate Factors in the Establishment of Introduced Fish Populations

The advent of geospatial environmental datasets has greatly enhanced the study of species distributions. Much research has aimed to estimate the bioclimatic envelope and assess the potential for rapid niche evolution in invasive species. The fundamental assumption of this approach is the range of each of the environmental variables defining a species' native climate niche accurately represents constraints on the species' distribution. In this study, we test for climate niche shifts in introduced populations of six species of cool-water fishes (Yellow Perch, Northern Pike, Walleye, Brook Trout, Rainbow Trout, and Lake Trout) in North America. Our results indicate significant niche differentiation has occurred in all species when comparing climate variables between native and introduced populations using univariate and multivariate analyses. In general, the trend is for introduced populations to occur in warmer, dryer climates with less seasonal variation in temperature compared to native ranges. Additional review of the data indicates a possible role of reservoirs in facilitating the niche shift as approximately half of all introduced populations are located in reservoirs. In conclusion, we suspect that shifts to climates with lower environmental selection pressures coupled with the hydrologic and thermal refugia offered by reservoirs are facilitating the establishment of populations outside of the native climate niche.

Dept of Biology, University of Rio Grande, Rio Grande, OH

P25 • David K. Cook, Jasmine N. Jordan, Alyssa A. Heisler, Charlene N. Miller, Junior Neal, Nicole M. Hughes

Effects of Regional Cloud Patterns on Microclimate and Shoot-Level Photosynthetic Gas Exchange in *Picea engelmannii* And *Abies lasiocarpa* At Treeline, Medicine Bow Mountains, Wyoming, USA

Summer atmospheric conditions in the Medicine Bow Mountains, USA are typified by clear mornings followed by convective, cumuliform cloud formation and thunderstorms in the afternoon. While cumuliform clouds generally reduce total incident sunlight via solar reflectance, it has recently been shown that partly-cloudy conditions can cause substantial increases in incident sunlight during cloud-gaps due to the summation of direct solar radiation with additional diffuse light scattered/reflected by cumulus clouds. Here we quantify the effects of cumulus solar-irradiance reflection (also described as the cloud-gap effect) on microclimate and photosynthetic gas exchange in saplings of two conifer species at treeline. Picea engelmannii and Abies lasiocarpa. Measurements were taken during both clear-sky and partly cloudy conditions (~10-70% of total sky covered by cumulus clouds) throughout the 2012 growing season within an alpine-treeline ecotone (3210 m elevation). Cumulus clouds generated dynamic fluctuations in photosynthetically active radiation (PAR), higher maximum PAR (>2500 µmol m⁻² s⁻¹), 2-3 fold increases in diffuse PAR, reduced mean and cumulative PAR, lower needle temperatures, and reduced leaf-to-air vapor pressure differences relative to clear-sky conditions. Cloud shade reduced total PAR by 24-94%, with corresponding declines in photosynthesis, needle temperatures, and transpiration occurring proportionally to cloud duration, frequency, and opacity. Despite increased diffuse light levels and greater maximum sunlight intensity during cloud-gaps, photosynthesis was never observed to be higher on partly cloudy days compared to clear days in either species, either during cloud-gaps or cloud-shade. Additional experiments tracking changes in photosynthetic gas exchange of individual shoots before, during, and after cumulus cloud-cover showed dramatic reductions in photosynthesis during cloud shade, followed by recovery to clear-sky rates during cloud-gaps. Reduced transpiration paired with high photosynthesis during cloudgaps also resulted in increased, instantaneous water use efficiency relative to clear-sky measurements. Photoinhibition in response to these abrupt and dramatic changes in PAR levels were not apparent. When photosynthetic light-response curves were integrated into

instantaneous PAR measurements on clear versus partly cloudy days each month, we estimated that cumulus cloud cover reduced daily carbon gain by 8-29% relative to clear-sky values. Significant reductions in transpiration under partly cloudy conditions resulted in significant alleviation of shoot water stress during most measurement months, relative to clear days, though the large variance between individual trees may have obscured results. We conclude that cumulus solar-irradiance reflection does not significantly increase carbon gain in this system during cloud-gaps. However, cumulus clouds may reduce daily and seasonal water stress by reducing needle temperatures and transpirational water loss during cloud-shade.

Dept of Biology, High Point University, High Point, NC

P26 • Alina Suedbeck, Tom J. Fink

How Lepidopteran Larval Spiracles are Really Made: The Lamellae

The external lamellae of larval spiracles are often easily noticed by eye or a stereo microscope. Despite their importance, the larval spiracle lamellar structure has been inadequately studied and described. Lamellae largely are considered to be fingerlike projections and in most cases lamellae are imaged with one or two surface Scanning Electron (SEM) micrographs. Larval lamellae in different species range from simple lamellae that can be described from two-dimensional micrographs, to in most cases lamellar carpets that must be imaged from three-dimensional analyphs or stereo pairs in order to correctly ascertain their structure and the differences between species. We find it necessary to image most larval spiracles with many stereo pairs taken from different angles of view. It is also necessary to make transverse cuts of the spiracles to see the true three-dimensional structure of the lamellae and to view the interior of the spiracles. In large species we also dissect the specimen so as to view the entire spiracle from the interior. Lamellar plates linked together to form lamellar carpets show an economy of structure so that air filtration tubercles, projections, or filaments are arranged only on the dorsum and laterally on the carpet that faces the other side. We will present images from over a dozen species, many through stereo anaglyphs, and some species will include first as well as mature and final instars. Many images are from live larvae imaged directly in a variable pressure SEM.

Biology Dept, East Carolina University, Greenville, NC

P27 • William H. Dees¹, Caleb M. Ardizzone¹, Jill Hightower², Taylor P. Wood¹, Alan M. J. Shudes¹, Terry L. Sylvester¹

Seasonal Surveillance of Adult Mosquitoes in a Renovated Residential Park

A seasonal longitudinal survey of adult mosquitoes is underway at a newly renovated, residential park. The total area of the woodland park is 24 acres. The park is separated into two distinct sections; one is an open area with playground equipment, picnic tables. open shelters, a small conference center, exhibits, wetland ponds, and concrete walking paths with benches; the other is a preserved forest with nature and hiking trails. The mosquito survey was initiated in summer 2011. We use Centers for Disease Control and Prevention (CDC) light traps baited with CO2 to collect mosquitoes. Mosquitoes are collected in the open area near the preserved forest in each of the four seasons: spring, summer, fall and winter. Meteorological data also are recorded during each trap night. The predominant species collected in a trap night (i.e. >50 mosquitoes) were Aedes taeniorhynchus, Ae. vexans, Coquillettidia perturbans, Culex nigripalpus, Cx. salinarius, and Psorophora columbiae. Mansonia titillans and Uranotaenia spp. were collected only in the fall. Culiseta inornata and Coquillettidia perturbans were collected in the winter and spring, respectively. Information obtained in this study can be used to determine potential health risks associated with nuisance and disease vector mosquito species. Data from this study also will broaden our understanding of mosquito population dynamics. Studies such as this are excellent for introducing undergraduate students to field research.

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P28 • Taylor E. Patzwahl¹, Joshua W. Campbell¹, James Martin ²

Pollinating and Beneficial Insects Within Four Treatments of Switchgrass and Pine

Currently, corn is the main source of ethanol in the United States and ethanol demand is expected to increase in the coming years. However, due to high environmental costs of corn, scientists are looking towards alternative biofuel crops that are more ecologically friendly. Switchgrass (Panicum virgatum) and loblolly pine trees (Pinus taeda) are two potential surrogates for biofuel production. Switchgrass produces more energy than it requires, emits less greenhouse gases, and can be grown on marginal land, leading to less competition of crop land for food production. Corn has also been shown to be detrimental to pollinating communities. The emphasis of my research is determining how pollinating/beneficial insect communities are affected by various switchgrass/pine treatments. Treatments included: (1 & 2) switchgrass intercropped with treatments of two different ages of pine, (3) monocultures of pine, (4) pine intercropped with native vegetation. Colored bowl traps (blue, yellow, white) were used to collect potential pollinators for each trapping period. Overall, different treatments attracted different genera of beneficial insects. At least 46 beneficial insect species were captured within our treatments. Ceratina strenua was the most prevalent bee found throughout the study followed by Lasioglossum spp. Both Ceratina and Lasioglossum depend on suitable nesting structure and some of our treatments may be providing the necessary structure. Dolichopodidae were found in significantly higher abundances within the pine monocultures. This may reflect an increase of prey items (e.g. aphids and other softbodied insects) exacerbated by the monoculture.

¹ High Point University; ² Mississippi State University

P29 • Rachel Pollard¹, Trip Lamb¹, Jason E. Bond²

Genetic Variation Corroborates Subspecific Delimitation in the Namib Fog-Basking Beetle, *Onymacris unguicularis* (Tenebrionidae, Coleoptera)

The fog-basking beetle, Onymacris unquicularis, is currently listed as a polytypic form comprising two subspecies. A flightless substrate specialist, the beetle is endemic to vegetationless dunes in Africa's Namib Desert, where southern populations constitute the nominate subspecies, O. u. unquicularis, and populations some 300 km to the north compose O. u. schulzeae. Their taxonomic descriptions are based on minor differences in pronotal and prosternal shape, and the phylogenetic validity of these subspecies has yet to be ascertained. Here we reassess the polytypic status of O. unquicularis by (1) examining diagnostic phenotypic characters in conjunction with a geometric morphometric analysis, and (2) conducting phylogenetic analysis of mitochondrial DNA sequences, Our results confirm pronotal and prosternal differences, which are complemented by geometric morphometric resolution of the subspecies. Phylogenetic analysis of DNA sequences recovered two reciprocally monophyletic lineages that exhibit perfect phylogeographic congruence with phenotypic variation. These genetic data identify southern and northern populations as distinct lineages, corroborate morphometric data regarding subspecific delimitation, and therefore support the recognition of O. u. unguicularis and O. u. schulzeae as valid taxa under the general lineage concept.

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P30 • Deirdre Gonsalves-Jackson, Andrea L. Rodriguez

Patterns of Development in Florida Opisthobranchs (Mollusca: Opisthobranchia: Gastropoda)

The developmental pattern of invertebrates is a significant component of life history, influencing population distribution, recruitment, genetic variation, and extinction. The most recent study examining developmental strategies in Florida opisthobranchs focused on one group of opisthobranchs (Order Ascoglossa). The purpose of this study is to examine developmental patterns in opisthobranch mollusks from the five major orders of

opisthobranchs from Florida. Specimens were collected from sixteen sites: 8 sites in the Florida Bay and 8 sites in the Atlantic Ocean. Living specimens were maintained at Keys Marine Laboratory (KML) in Long Key where species were identified and cultured to document embryonic development and determine developmental mode. Twenty-one percent of collected species (n=3) spawned in the laboratory. The size of spawn, size and volume of the egg capsules, and egg diameter were recorded upon deposition. Embryonic development was observed daily through hatching. Mode of development was inferred for embryos not surviving through hatching. Egg diameter ranged from 140-158 μ m. Two species, Haminoea antillarum and Phyllaplysia engeli were determined to have Type 3 development. Based on the small number of eggs per mass and large egg diameter, development for the third species, Ercolania fuscata, is hypothesized to be either Type 2-lecithotrophic or Type 3-encapsulated development. Based on these results and modes of development documented in the literature record for Florida opisthobranchs (n=56), the Florida opisthobranch fauna appears to be predominately Type 2 (lecithotrophic) or Type 3 (direct development), in contrast to Thorson's Rule.

Virginia Wesleyan College

P31 • William H. Dees¹, Adam D. Richard¹, Jesse P. Dupre¹, Sawyer M. McMicken², Caleb M. Ardizzone¹, Omar E. Christian², Cecilia W. Richmond³, Jill Hightower⁴, Janet R. Woolman³

The Effect of Extracts and Freshly-Cut Parts From Louisiana Native Plants on Aedes aegypti Mosquitoes

We evaluated the effect of extracts and freshly-cut parts from plants native to Louisiana on female Aedes aegypti mosquitoes. The following plants were used in making hexane, acetone and methanolic extracts: Rattlesnake Master, Eryngium yuccifolium, Cluster Bushmint, Hyptis alata, and Wooly Rose Mallow, Hibiscus lasiocarpus. The following plants (and plant parts) were used in experiments of freshly-cut plants; E. yuccifolium (leaves and flowers), Coreopsis, Coreopsis lanceolata (leaves and petals), American Beautyberry, Callicarpa americana (leaves and unripe berries), and Slender Mountain Mint, Pycnanthemum tenuifolium (leaves and flowers). For the extract experiments, mosquitoes were placed in standard glass Petri dishes treated with extracts. For the experiments with plant parts, standard plastic Petri dishes were used to hold mosquitoes and cut plant parts. A 10% sucrose solution served as a food source for mosquitoes during the Petri dish tests. We recorded percent mortality at 24, 48, 72 and 96 h. We also recorded percent mortality at 168 h for the extract experiments. We observed 57% mortality in adult mosquitoes after 24 h exposure to methanolic extracts of E. yuccifolium buds. After 7 days (168 h), we observed 96% mortality in mosquitoes exposed to hexane extracts of Hyptis alata stems and 93% mortality in mosquitoes exposed to methanolic extracts of E. yuccifolium buds. Mosquitoes exposed to freshly-cut leaves of all plants, except P. tenuifolium, exhibited greater mortality than controls. We observed up to 85% mortality in adult mosquitoes after 24 h exposure to freshly-cut flowers of E. yuccifolium.

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P32 • William H. Dees¹, Jesse P. Dupre¹, Adam D. Richard¹, Sawyer M. McMicken², Caleb M. Ardizzone¹, Omar E. Christian², Cecilia W. Richmond³, Jill Hightower⁴, Janet R. Woolman³

The Effect of Louisiana Native Plant Extracts on Ovipositing Aedes aegypti Mosquitoes

We evaluated the effect of Louisiana native plant extracts on ovipositing Aedes aegypti mosquitoes. Bioassays were conducted in screened cages (46x46x46 cm) containing plastic cups lined with germination paper on which eggs were deposited. Each cup contained 60 mL distilled water and 10 uL of hexane, acetone or methanolic plant extracts. Extracts were made from the following plant parts: (1) stems and roots from

Cluster Bushmint, *Hyptis alata*; (2) stems and roots from Wooly Rose Mallow, *Hibiscus lasiocarpus*; and (3) buds, stems and roots from Rattlesnake Master, *Eryngium yuccifolium*. The bioassay was conducted for 24 h. After 24 h, the germination paper in each cup was removed and the eggs on each paper were counted. We calculated the oviposition activity index (OAI) for each extract. Hexane extracts of *E. yuccifolium* buds and roots and the acetone extract of *E. yuccifolium* stems repelled ovipositing mosquitoes. Ovipositing mosquitoes were slightly attracted to hexane extracts of *E. yuccifolium* stems, methanolic extracts of *Hyptis alata* roots and methanolic extracts of *E. yuccifolium* stems and roots. Ovipositing mosquitoes demonstrated the greatest attraction to acetone, hexane, and methanolic *Hibiscus lasiocarpus* root extracts. The OAI ranges for the *H. lasiocarpus* root extracts were (+)0.32-0.41 on a scale of (+)1 (attraction) to (-)1 (repellency).

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P33 • Orlando Benavides, Raquel Casado, Rosario Rodriguez, Gretert Montano, Frank Coro

Phonoresponses of Female Moths With Two-Celled Ears to Different Acoustic Signals Emitted by Sympatric Insect Species

Syntomeida epilais (Arctiidae), the object of our study, is one of the moth species with two-celled ears that have been demonstrated to need acoustic communication for successful mating behavior. The aim of our study is to analyze if perched S. epilais females could discriminate the emissions produced by conspecific males from other ultrasonic stimuli present in their environment. We stimulated 20 virgin females with playback recordings of conspecific male and female signals and of emissions from another two-celled ear moth species (Empyreuma affinis). Stimulation signals were applied and recordings of phonoresponses from stationary S. epialis females were obtained outdoors during the hours of its mating behavior (3:30-6:30 AM). The responses were quantified by counting the number of modulation cycles produced by the female per applied stimuli and by measuring the latency to the first stimulus of the series. All 20 female phonoresponded to their conspecific male emissions, while 12 responded to their conspecific female emissions, 6 to the E. affinis female emissions, and only 2 to the male signals of E. affinis. After responding to the conspecific male emissions, we decapitated 3 S. epilais females. None of the headless females responded to any of the applied stimuli. This result differs radically from that obtained in another two-celled ear moth (Cycnia tenera), that continued to phonorespond headless. These results on the whole demonstrate that S.epilais females phonorespond preferentially to their conspecific male emissions, suggesting for the first time physiological adaptations for intraspecific acoustic communication in moths with two-celled ears.

School of Science, Miami Dade, Miami FL

P34 • Michelle R. Kelley, Jennifer A. Hancock

The Relationship Between Achilles Tendon Dimensions, Gait Transition Speed and Sprint Speed in Humans

The purpose of this study was to determine the relationship between the length, width, thickness and moment arm of the Achilles tendon and gait transition speed and sprint speed. For this study, the participants were 18 to 25 years of age and did not have any known Achilles tendon pathologies or current lower limb injuries. Forty participants were recorded from a lateral view as they naturally transitioned from walking to running on a treadmill. This was done by incrementally increasing the speed of the treadmill during 3 trials. The videos were reviewed to find the gait transition speed, which was the speed of the tread during the first step in which an aerial phase occurred. Participants also sprinted 25 meters on an indoor track. Their times were recorded for 3 trials and their mean sprint

speed was determined. Additionally, the dimensions of the Achilles tendons in both legs were measured using ultrasonography. Then, relative measurements were calculated for each tendon dimension. Length and moment arm measurements were divided by hip height, and width and thickness measurements were divided by weight. Finally, the mean gait transition speeds and sprint speeds will be regressed against the relative tendon dimensions. It is expected that there will be a relationship between relative Achilles tendon dimensions and both mean gait transition speeds and mean sprint speeds.

Dept of Biology and Environmental Science, Marietta College, Marietta, OH

P35 • Breea N. Buckley, Jennifer A. Hancock

The Relationship Between Achilles Tendon Dimensions and Vertical Jumping in Humans

This study will determine if there is a relationship between vertical jumping ability and the dimensions of the Achilles tendon in humans. The moment arm (MA), length, thickness and width of the Achilles tendon were measured using ultrasonography in forty participants that were between 18 and 25 years of age and did not have any known Achilles tendon pathologies or current lower limb injuries. Relative measurements were calculated for each tendon dimension. Length and moment arm measurements were divided by hip height, and width and thickness measurements were divided by weight. Participants also performed a series of jumps, including a countermovement jump, squat jump with an arm swing, and a vertical jump on each leg. All jumps were recorded with a high-speed camera from a lateral view and then jump height was measured from the videos. The relative tendon dimensions will then be regressed against the jump heights. It is hypothesized that individuals with longer tendons and longer moment arms will be able to jump higher. Research findings will contribute to research on the physiology of the Achilles tendon as well as the development of exercise and physical rehabilitation programs.

Dept of Biology and Environmental Science, Marietta College, Marietta, OH

P36 • John F. Menz¹, Andrew G. Gardner¹, Kelly A. Shepherd², Spencer Willis, Rachel S. Jabaily¹

Getting Into Shape: Morphometric Analysis of Floral Symmetry Variation in Goodeniaceae

The Goodeniaceae is a principally Australian family of wildflowers, with its highest species diversity in the Southwestern Australian Floristic Province. The family displays diverse petal symmetry variation including actinomorphic, bilabiate, and fan-shaped flowers. This evolutionary lability may have been a key driver of diversification in the family. In this study, we used geometric morphometrics to characterize floral symmetry for 28 species of Goodeniaceae. Morphometrics uses homologous landmarks to allow for quantitative comparisons of the shapes of objects. While evolutionary developmental biology has adapted morphometric theory from fields such as archaeology and utilized it as a powerful tool for comparative analyses, most biological applications have thus far been limited to animal models. An average of 8.75 head-on photos of each species' flowers was taken in the bush, which were then digitally landmarked. Photo-specific variation was minimized by performing a Procrustes transformation and relative warps analysis using morphometric freeware. We sought to test intra- and interspecific variability of floral form to quantitatively define discrete floral morphological bins and to assess levels of correlation among the floral landmarks, allowing us to define potential developmental modules. Species were clustered into multiple discrete floral symmetry bins for future phylogenetic study. The majority of interspecific floral variation was determined through PCA analysis to be encompassed by landmarks on dorsal and lateral petals, with minimal variation within species. This study determined that geometric morphometrics is a viable method of objectively comparing and characterizing floral morphology.

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P37 • Charles F. Smith, Catherine Eason

Facultative Parthenogenesis in North American Pitviper Snakes in the Wild

Facultative parthenogenesis (FP) - asexual reproduction by bisexual species - has been genetically confirmed in a variety of multicellular organisms but only recently in snakes, varanid lizards, birds, and sharks. Unlike the approximately eighty taxa of unisexual (obligate parthenogenetic) reptiles, amphibians, and fishes that exist in nature, FP has only recently been documented in wild vertebrate populations. Here, using microsatellite DNA genotyping and litter characteristics, we report progress on determining the prevalence of FP in a wild population of North American pit viper snakes from which the first case of FP was documented (copperhead snake, *Agkistrodon contortrix*).

Dept of Biology, Wofford College, Spartanburg, SC

P38 • Edward D. Mills

Spectral Characteristics of Hatchling Chinese Blue-Breasted Quail (Coturnix chinensis) Vocalizations

Galliform birds can produce as many as twenty different vocalizations that range from contact calls to alarm calls. Many of these calls are believed to be innate, although they may become modified as the bird ages. Chinese Blue-breasted Quail (*Coturnix chinensis*) generate an A-shaped vocalization immediately after hatching that is likely a contact call that maintains the cohesiveness of the precocial family group while foraging. *C. chinensis* is a territorial quail that produces as many as thirteen eggs in a clutch, and when the young hatch, they begin calling immediately. The vocalizations of hatchlings were digitally recorded directly after being placed in a brooder. Their A-shaped calls exhibit harmonic stacks with the fundamental frequency around 3700 Hz and three harmonics at approximately 9000, 14,000 and 18,600 Hz. Eleven spectral properties were measured to form a baseline to examine developmental changes that occur as the juvenile birds age. These measurements include call length, sound frequencies produced (Hz), and call decibels (average and maximum power, dB).

Dept of Biology; ² Wingate University; ³ Wingate; ⁴ NC

P39 • Charles L. Kimmel¹, Alexander Krings¹, Jon Stucky¹, David Crouse²

The Vascular Flora of William B. Umstead State Park

William B. Umstead State Park (5,439 ac) is one of the most heavily visited parks in North Carolina. Since the last floristic inventory of the park, 46 years have passed and the park has expanded by roughly 1300 acres. The aim of this project is to provide an updated inventory, through intensive survey of the newly acquired acreage, as well as to provide a user-friendly taxonomic guide to the flora of the entire park. Over the past year, plant vouchers were collected during the growing season twice a week and during the off season at most biweekly. Vouchers are stored in the North Carolina State University herbarium, along with tissue samples, preserved in silica gel, for future DNA analysis. So far, over 600 specimens have been collected (in duplicate). In addition to field collections resulting from this effort, pertinent herbarium specimens from the University of North Carolina at Chapel Hill, Coker College, Duke University and North Carolina State University will be examined and cited. Park soils and topography will also be included in the guide using the Wake County GIS data service. Three species are newly reported for the park *Cryptomeria japonica*, *Magnolia grandiflora* and *Taxodium distichum*.

P40 • Amanda Garrison, Gerald L. Smith

Populational Investigation of Spider-Lilies Distributed in the Atlantic Coastal Plain

The *Hymenocallis* treatment in *Flora North America* (vol. 26) recognizes two species inhabiting the Atlantic Coastal Plain, *H. crassifolia* Herb. and *H. pygmaea* Traub. *Hymenocallis crassifolia* is distributed from the Coastal Plain of the Carolinas to

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Northeastern Florida; *H. pygmaea* is endemic to the Waccamaw River drainage and possibly in other adjacent drainages. We conducted an ISSR finger-printing study of several populations of *H. crassifolia* and *H. pygmaea*. The gels were scored and the data used to build a matrix which was analyzed in PAUP* 4.0b2. The tree that was generated from the matrix in MacClade 4.0 revealed that the populations of these two species sorted into separate clades. We regard these results as supporting the distinctiveness of these two species. In the analysis, we also included several other species of Traub's Caroliniana alliance to see if we could get an indication of sister relationships.

Biology Dept, High Point University, High Point, NC

P41 • Allison N. Welborn, Conley K. McMullen

A Floristic Survey of Smith Creek Restoration Area, Rockingham County, Virginia

Smith Creek Restoration Area, in Rockingham County, Virginia, comprises a 1.5 mi section of creek and a 66 ft buffer zone along either side. Prior to the beginning of this study, for ca. 200 years, the property had been used for agriculture/pasture. As a result, the creek had become unsuitable as a habitat for native brook trout, and most of the native plants in the immediate area were lost. In 2006, the land bordering the creek was made available for a restoration study, and thousands of trees were planted in the hopes of eventually returning the area to its natural condition. The purpose of the research described here is to catalog the native vascular plant species that occur in this area, thus providing baseline data for future studies that might occur as the landscape changes due to the tree plantings and the absence of agricultural and grazing pressures. Results thus far will be discussed.

Dept of Biology, James Madison University, Harrisonburg, VA

P42 • Casie L. Reed, Alexander Krings, David L. Lindbo, Jon M. Stucky

The Vascular Flora of the Eno River Diabase Sill Plant Preserve (Durham County, North Carolina)

Named for the diabase formation over which it occurs, the Eno River Diabase Sill Plant Preserve is a Nationally Significant Natural Heritage Area located in Durham, North Carolina. The mafic soils that derive from the underlying diabase are regionally rare, resulting in unique plant assemblages on the preserve. At only 358 acres, the site supports a high species diversity, including eleven state-listed taxa, one of which is federally endangered. Despite its exceptional geological and botanical features, research on the site has been limited, and no comprehensive floristic inventory has been conducted. The goal of this study is to produce a taxonomic manual to the vascular flora of the preserve based on field observations and herbarium records. To date, 674 specimens have been collected and archived in the NCSC herbarium. Site visits, herbarium research, and plant identification efforts are ongoing. Once completed, the manual will provide baseline data necessary for management and will facilitate future studies of plants that occur on the preserve.

North Carolina State University

P43 • Scott D. Silvis¹, Kevin Burgess¹, Julie Ballenger¹, Michele Elmore²

Documenting the Diversity of the Fall-Line Sandhill Flora Using Plant DNA Barcodes

DNA barcode libraries are fast becoming incorporated into the restoration and conservation management plans of local floras, especially where taxonomic complexity can confound plant identification based on morphology alone. Based on a combination of high sequence quality and high species discrimination success, the Consortium for the Barcode of Life (CBOL) has recently adopted the <code>rbcL+matk</code> gene region of the chloroplast genome as the core Barcode for plants. This study represents a preliminary evaluation of the potential use of this barcode to establish a genetic library for the Sandhill Flora of Georgia, a fragile and threatened habitat of moderate phylogenic dispersion that holds a large number of rare and endangered plant species. To assess DNA sequence variation for this barcode region, DNA and Herbarium vouchers were collected for ~200

species (99 genera, 72 families) across a series of 11 wetland habitats near Fort Benning, Georgia. To conduct an initial evaluation of % sequence recovery and % species resolution for this flora using this barcode region, forward and reverse sequencing was conducted on a subset of taxa for the *rbcL*-portion of the plant DNA barcode. Sequence recovery was relatively high and comparable with studies of similar taxonomic composition. Species resolution (62%) was relatively low, but expected, for a flora with a relatively high composition of polytypic genera (49%). This study underscores the potential utility of establishing a barcode library of the Sandhill region of Southwest Georgia for future ecological, conservation and restoration applications.

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P44 • Amanda Faucette¹, Alexander Krings¹, David L. Lindbo², Jon M. Stucky¹

Guide to the Vascular Flora of Buxton Woods (Dare County, North Carolina)

Buxton Woods Coastal Reserve (BWCR) is a 403 ha (995 ac) Significant Natural Heritage Area (R1 C1) located on Hatteras Island in Dare County, North Carolina. Due to the mix of Labrador and Gulf currents off the coast of Cape Hatteras, BWCR contains a rich diversity of subtropical and temperate plant species and comprises the largest tract of maritime evergreen forest (G2) left on the North Carolina coast. In order to effectively manage and preserve the biodiversity of BWCR, a comprehensive floristic inventory and mapping of current plant communities was considered a top priority in its management plan. The objectives of this study were to: 1) to document the vascular flora of each of the natural plant communities with voucher specimens, as well as leaf tissue samples for DNA banking; 2) to map plant communities in relation to soil map units within the site; 3) to develop a taxonomic manual with keys to the vascular flora. To date, 396 specimens have been collected, representing over 200 species. Summary floristic statistics will be presented and discussed. Ultimately, keys will be provided to all reported species and genera, including: habitat, phenology, relative abundance, illustrations, relevant voucher information, and synonymy with published floras.

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P45 • Amanda M. Thornton¹, Ross A. McCauley², J. Christopher Havran¹

Interisland Biogeography of the Endemic Hawaiian Genus Nototrichium (Amaranthaceae)

Nototrichium (Amaranthaceae) is a genus containing three species of shrubs to small trees that are endemic to the main Hawaiian Islands. We conducted a phylogenetic study of the genus to elucidate its origins and interisland biogeography. DNA from all species of Nototrichium, including N. sandwicense from each island, was extracted from field and herbarium specimens. DNA was also extracted from several Pacific representatives of the closely related genus Achyranthes. Extracted materials were sequenced and aligned for the Internal Transcribed Spacer (ITS) region, Additionally we investigated four other gene regions including petL-psbE, rps16-trnK, rp/32-trnL and G3PDH for inclusion in the phylogeny. Our analyses using Maximum Parsimony Analysis showed that Nototrichium is monophyletic, however, N. sandwicense is paraphyletic. There appears to be a geographic correlation to the distribution of two clades within the genus. A more specious clade is associated with the older, western islands of Kauai and Oahu whereas a less specious clade is associated with the younger, eastern islands of Molokai, Lanai, Maui and Hawali. Our analyses of the relationship between Nototrichium and Achyranthes confirm our earlier findings of an Asian origin of Nototrichium. Of the additional tested chloroplast regions, rp/32-trnL sequenced well and will be incorporated into future phylogenies of the genus. In the future, we plan to investigate additional nuclear and chloroplast gene regions in order to assemble a more robust phylogeny of Nototrichium.

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P46 • Jennifer S. Kluse, Lowell E. Urbatsch, Yalma L. Vargas-Rodriguez

Digitization of Specimens in the Louisiana State University Herbarium: Progress and Potential of on-Line Databases

As herbaria collaborate to bring their collections online, we are starting to see a clearer picture of the history of biological collection efforts and the emergence of a biogeographical map of species over the recent past. Since the Louisiana State Herbarium began manually databasing in the early 1990s, it has been charting digitization efforts. Today national collection consortiums, some of which the LSU herbarium is associated, have accelerated efforts to digitize and manual databasing has become semiautomated. Currently, digitized collections at Louisiana State University Herbarium (LSU) and The Bernard Lowy Mycological Herbarium (LSUM) have increased to include 74% of vascular plants, 68% of lichens, 78% of bryophytes, and 31% of fungi, for a total collection of approximately 225,000 specimens. Georeferencing these records has just begun and will increase our spatial understanding of these collections. Though each herbarium has unique circumstances for imaging and databasing, several methods have been established at LSU in order to increase efficiencies. Overall, digitization will result in collections being studied in a whole new way as new scientific queries can be answered. Collection Consortiums are asking broad questions such as 1) effects of Climate Change on North American lichen and bryophyte distributions and 2) the impact of human land use on fungi globally. More specifically, LSU is interested in creating a regional flora and finding localities for which where there is a paucity of data in order to direct further collection efforts. In general, the efforts to digitize biological collections will increase their value and help to direct future scientific research.

Dept of Biological Sciences, Louisiana State University, Baton Rouge, LA

P47 • Molly Klinepeter, Rachel Schomaker, Gabriel Herrick, Celina Bellanceau

Biomonitoring of Freshwater Invertebrates in Lake Hollingsworth

Management decisions about aquatic habitats are often made based on results of biomonitoring for macroinvertebrate fauna, fish, and/or algae. We chose to assess the invertebrate community for abundance and diversity of taxa found in different aquatic habitat types. We collected freshwater invertebrates from four different kinds of vegetated habitats present in Lake Hollingsworth in Lakeland, Florida. We hypothesized that the type of habitat would affect the diversity and abundance of invertebrates living in Lake Hollingsworth. We also expected that vegetated habitats would have greater diversity and abundance of invertebrates compared to non-vegetated habitats. We found that habitat type does affect the diversity and abundance of invertebrate species. Further investigations are underway to determine seasonal shifts in community structure, geographical differences among lakes in the region, and to tease apart some of the causal processes that result in observed patterns of community structure.

Dept of Biology, Florida Southern College, Lakeland, FL

P48 • Michael W. Beasley, Jennifer L. Greenwood

Diatom Biodiversity of North Branch Pawpaw Creek, a Stream Near Reelfoot Lake, Northwest Tennessee

PawPaw Creek is adjacent to the Reelfoot Lake watershed south of Samburg, TN. Very little is known about diatom communities from Reelfoot Lake and the surrounding aquatic habitats. Our goal was to describe the diatom communities from the major microhabitats in PawPaw Creek. Qualitative samples were taken during June 2012 and 2013 from epipsammon, epilithon, epiphyton from vascular plants and epiphyton from mats of the filamentous xanthophyte alga *Vaucheria*. Permanent diatoms slides were made and diatom frustules from 10 transects or 300 diatom frustules from each slide were identified to species. Non-metric multidimensional scaling was performed on arcsine square-root transformed relative abundance data to assess differences in communities among microhabitats. Over 20 genera and 40 species of diatoms were identified. *Gomphonema*

parvulum, G.truncatum var. capitata, Navicula lanceolata, Nitzschia amphibia, and Rhoicosphenia curvata were among the dominant species. Communities from inorganic substrata regardless of year were more similar to each other than they were to communities from epiphytic substrata. Communities from the two types of epiphytic substrata were similar to each other within the same year, and showed strong differences between years.

Dept of Biological Sciences, University of Tennessee at Martin, Martin, TN

P49 • Jonathan Brink, Eddie Barnett, Nicholas Stacy, Alex Collier, Brett Larson

Palatable Species of Amphibians are More Heavily Impacted by Visual and Chemical Cues of Predatory Fish

In this study, relatively unpalatable toad larvae (Bufo terrestris) and palatable leopard frogs (Lithobates sphenocephala) were reared in 20 cm diameter PVC pipes drilled with aeration holes to allow water flow. These PVC chambers were submerged in 75 L aquaria. In half of the treatments, the chambers were white, preventing any visual cues between predators and prey. A second group of tadpoles were reared in clear chambers that permitted visual cues. Predatory bluegill (Lepomis macrochirus) or largemouth bass (Micropterus salmoides) swam freely between the chambers. The predators were offered a diet of conspecific prey that they were paired with although toad tadpoles were rarely consumed. Control tadpoles were isolated in both clear and white PVC chambers in aquaria with no fish. The length (mm) and weight (g) of tadpoles were recorded at regular sampling invtervals throughout their developmental period. In both the non-visual and visual treatments, toad tadpoles did not statistically differ from control animals regardless of predator species. The most significant impact on prey growth was observed among leopard frog tadpoles reared in visual chambers with largemouth bass. These tadpoles were significantly smaller than control animals and suffered heavy mortality during the study. These results support the notion that prey palatability can affect the impact of visual and chemical cues of predatory fish.

Armstrong Atlantic State University

P50 • Katharine Horning¹, Troy Mutchler², William Ensign³

Exploring the Impacts of Urbanization on Stream Food Webs: Does Urbanization Affect Periphyton Abundance and Composition?

Periphyton is a key component of stream food webs because the organisms and detritus within the matrix represent important sources of organic matter for higher trophic levels. The abundance and composition of organisms that constitute periphyton is, in part, a function of water quality and light availability. In many locations, water quality is being modified by urbanization in ways that may impact the quantity and quality of periphyton as a food source. For instance, urbanization typically involves reductions in tree cover and proliferation of impervious surfaces that togethermay increase irradiance, nutrient inputs. and water temperatures in streams, conditions that commonly favor growth of filamentous Chlorophytes. Such changes can be important for stream fauna because the community composition also affects the nutritional value and palatability of periphyton. We sampledperiphyton along a gradient of urbanization in 12streams throughout Cobb and Paulding County, GA todetect patterns in standing stock and community structure. We sampled 6 different transects along a reach within each stream and quantified total chlorophyll, biomass, and relative abundance of algaltaxa. Preliminary results indicate that algal abundance was dominated by a diversity of species within theBacillariophyceae, Cyanophyta and Chlorophyta, Comparisons will also be made of the total chlorophyll and biomass among the streams to determine if urbanization affects the quality and quantity of food available along a gradient of urbanization.

¹ Kennesaw State University; ² Kennesaw State University; ³ Kennesaw State University

P51 • Casey Quade, Beth Drobinski, William Ensign

Univariate and Multivariate Assessment of Habitat Preferences of Stream Fishes

Urbanization alters physical habitat in streams and has been implicated as a factor leading to reduced fish diversity in urban streams. Evaluating the importance of habitat alteration requires an understanding of fishes' preferred habitats and the appropriate scale of measurement to use in assessing those habitat features. The purpose of this study is to assess two different approaches for quantifying fish habitat preferences to determine which most adequately characterizes habitat use compared to expected patterns determined from the literature. Fish were collected at 12 sites from streams in the lower Etowah River Basin using backpack electroshockers. At each site, the study reach was divided into six sections of equal length and fish from each section were identified and counted. Water depth, water velocity and substrate composition were assessed at six randomly selected points in each of the six sections. Habitat preferences for three species, Lepomis auritus, Percina nigrofasciata and Campostoma oligolepis were estimated using a univariate approach where depth, velocity and substrate were treated separately and a multivariate approach where the three habitat variables were combined into a series of coded categories. The univariate approach produced habitat relationships that corresponded poorly to literature descriptions of the preferred habitat of the three species. In contrast, the multivariate approach produced habitat relationships similar to those found in literature descriptions of the preferred habitat of the species. Our results suggest that fish are responding to interactions among the measured habitat variables and a univariate approach to habitat description has limited utility.

Dept of Biology and Physics, Kennesaw State University, Kennesaw, GA

P52 • Lindsay J. Brooks¹, Joshua W. Campbell¹, Julie W. Murphy²

Bioaccumulation of Total Mercury in Wilson Snipe (Gallinago delicata) From Alabama

Mercury is a persistent toxic heavy metal that can bioaccumulate in organisms causing diseases and other health problems. Higher trophic level birds have been shown to be sensitive to toxins in their environment. Wilson's snipe ($Gallinago\ delicata$) feed primarily on aquatic invertebrates and many of these aquatic ecosystems are prone to mercury bioaccumulation. In this study we measured total mercury (Hg) in the Wilson's snipe to determine whether this bird species could be used as a biological indicator for mercury bioaccumulation. Total mercury was measured in the feathers and muscle tissue. Mean concentration (ppm) of mercury was 1.33 ppm and 0.0874 ppm in the feathers and muscle tissue respectively. Mercury concentration (ppm) was significantly higher in feathers compared to muscle tissue (P=0.0002). Our data suggests that the Wilson's snipe, an aquatic invertebrate predator, does bioaccumulate mercury from their environment and could be a useful biological indicator for mercury.

P53 • Somuayiro N. Nwokike, Rebecca L. Tucker, Benjamin C. Webster, Matthew N. Waters, Gretchen K. Bielmyer

The Effects of Water Quality, Habitat and Land Use on the Biodiversity of Stream Macroinvertebrates in South Georgia

Macroinvertebrates are good indicators of stream health for localized aquatic ecosystems. Previous work shows that water quality, habitat and surrounding land use impact macroinvertebrate community structure inhabiting the streams. We sampled macroinvertebrates from four streams of different order and land use located in Lowndes County, South Georgia. The Withlacoochee River is order 4 with forest/ag/urban land use. The Little River is order 3 with forest/ag land use. Sugar Creek is order 2 with urban/forest land use, and One Mile Branch is order 1 with urban land use. Specimens were trapped using kick nets and hand collection techniques; then identified and placed into specific pollution resistant groups to determine stream health. Each stream's biodiversity and Beck's Index were later recorded. Despite differences in land use and stream order, these

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four streams are considered healthy according to Beck's Index and other stream health indices. It was found that pollution resistant macroinvertebrates were seldom seen; however when they were found, Becks Index for that sample dropped dramatically and the sampling's overall health had a negative drop. When the biodiversity was high, the stream's health score was positive as well. Biodiversity showed to have a strong correlation with the stream health. Despite different orders and land use, these streams all contained complex heterogeneous habitats with sufficient substrate for biofilm production. This habitat complexity could provide the mechanism for healthy stream scores.

Dept of Biology, Valdosta State University, Valdosta, GA

P54 • Leanna R. Tacik, Annie Choi, Andreas N. Gregoriou, Carly Martin, Kaitlyn D. Peters. Kenneth Fortino

The Abundance and Decomposition of Coarse Particulate Organic Matter in Man-Made Ponds in Central Virginia

Globally, man-made ponds and reservoirs approach the abundance of natural lentic systems. Furthermore, in regions that lack natural lakes, man-made ponds tend to be the dominant lentic habitat. However, our knowledge of the ecology and biogeochemistry of man-made ponds lags behind that of natural systems. In natural ponds allochthonous detritus input can represent a substantial proportion of the total organic matter budget. The decomposition of this detritus supports macroinvertebrates and fuels production across trophic levels. Our project investigates whether the role and regulation of allochthonous litter decomposition in man-made ponds differs from this model. Spring sampling of 4 man-made ponds in central Virginia shows that the median coarse particulate organic matter (CPOM) pool, mainly comprised of allochthonous detritus, ranged 20 - 243 g m⁻² and was variable among and within ponds. Comparison of CPOM density and the percent organic matter of the sediment, determined as loss on ignition at 550° C, shows a complex relationship between detritus input and sediment organic matter content. Direct measurement of decomposition using litter bags in 3 ponds during the fall and winter months showed similar mass losses across ponds. Unlike natural ponds. detrital mass loss appears to be due to microbial activity because virtually no shredding macroinvertebrates were recovered from the litter bags or the CPOM samples. These results suggest that the decomposition of allochthonous detritus is an important component of organic matter cycling in man-made ponds but that its regulation may rely on factors different from those identified from natural ponds.

Biological and Environmental Sciences, Longwood University, Farmville, VA

P55 • Charles R. Watt, Corey A. Swanson, Dillon A. Miller, Alaina C. Esposito, Christine L. May

Experimentation Reveals How Brook Trout Adapt Body Coloration to Match Substrate Conditions and Social Hierarchies

Phenotypic plasticity in fish is commonly used as a means of camouflage and as a means of intraspecific communication. The ability of resident trout to alter their coloration to match the local substrate, and how this is affected by stressors, is poorly understood. Experiments conducted in artificial stream channels with native brook trout tested for the potential of color matching by varying light and dark substrates, and included treatments with individuals as well as with paired cohorts to test for the effect of stress on this phenomenon. Fish displayed a broad ability to adapt their coloration to match a range of substrates. The baseline or resting colors that were established for dominant and subordinate individuals in paired trials showed trends that displayed the tendency for dominant fish to match to light substrate more effectively while subordinates displayed darker coloration; however, there was substantial variation among cohorts depending upon their aggressiveness. This ongoing research provides new insight into a form of camouflage not typically associated with salmonid fishes, and how it is mediated by social hierarchies.

Dept of Biology, James Madison University, Harrisonburg, VA

P56 • Pratikkumar P. Patel, Christina G. Duckworth, Erika L. Schumacher, Gretchen K. Bielmyer, Mattew N. Waters

Assessment of Heavy Metal Contamination in the Biota of Four Rivers With Varying Degrees of Human Impact

Changing land use may influence river ecosystems to varying degrees. Metal pollution in aquatic environments is a reported consequence of elevated anthropogenic inputs, particularly from densely populated areas. The objectives of this study were to quantify metal (Cu, Al, Cd, Ni, Pb) concentrations in the waters and biota of four streams (One Mile Branch, Sugar Creek, Withlacoochee River, and Little River) in South Georgia, each with varying levels of anthropogenic impact. Water and tissue samples from each stream were analyzed for metals using atomic absorption spectrometry. Additionally, the macrophytes and fish were identified to assess biodiversity at each site. Metal concentrations in fish tissue differed between sites and among species, corresponding to metal concentrations in the water for Cu but not for Al. Ni. Cd. and Pb. Withlacoochee (fourth order) and Little River (third order), both being heavily impacted by anthropogenic sources, contained the highest metal concentrations in the water but not in fish tissue compared to Sugar Creek and One Mile Branch (second order and first order streams, respectively). Macrophytes are still being analyzed for metals. The biological diversity of each sampling site was calculated using Shannon-Weiner and Simpson's Index of Diversity. According to Simpson's Index of Diversity, all streams were of similar community structure.

Biology Dept, Valdosta State University, Valdosta, GA

P57 • Autumn B. Forschler-Turner¹, Terry D. Richardson

Effect of Total Suspended Solids on the Foraging Capacity of the Stream Snail, *Pleurocera canaliculata*

Total suspended solids (TSS) are thought to be among the leading non-point source pollutants contributing to habitat degradation and subsequent biodiversity decline in freshwater ecosystems. There is little conclusive information linking TSS and disruption of behaviors such as foraging among organisms that frequently encounter high levels of TSS in natural settings. This study directly examined the effects of increased TSS on the foraging capacity of the pleurocerid Silty hornsnail, Pleurocera canaliculata. Snails were offered weighed spinach disks during exposure to increasing levels of TSS. TSS exposure ranges for control were 0.0-5.0 NTUs, low 5.1-10.0, medium-low 10.1-20.0, medium-high 20.1-35.0, and high 35.1-55.0. These are comparable to natural levels ranging from <5.0 up to 55.0 NTUs. Feeding rate declined proportionately to increased TSS. Relative to mean control feeding rates of 11.77 mg/day (± 1.09 SE), consumption was significantly reduced to 6.71 (± 2.65) and 3.89 (± 1.12) for medium-high and high TSS exposure, respectively. Feeding rates at medium-high and high TSS exposure were also significantly lower than the consumption rates of 10.33 (± 2.21) and 13.62 mg/day (± 1.83) at medium low and low TSS exposure. Consumption rates for medium-low and low TSS exposure were not significantly different from control values. The decrease in feeding rate as a result of increased TSS suggests that natural levels of TSS may significantly impact foraging behavior in the Silty hornsnail. Such changes in foraging behavior that affect consumption rates, and subsequently energy budgets, could have long term consequences on snail fitness and survival.

P58 • Manuel B. Bernal Mejia, Tonya C. Carver, Margaret K. Kovach

An Analysis of Differentially Expressed Genes in the Context of Cochlear Malfunction in Charcot-Marie Tooth Syndrome

A goal of medicine is to better understand the relationship between disease and abnormal gene expression patterns. In order to better understand the genetically inherited disease, Charcot-Marie Tooth (CMT), we profile abnormally expressed genes throughout the development of the Trembler-J (TrJ) mouse carrying a mutation within the peripheral

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myelin protein-22 (pmp22). CMT is characterized by improper motor and sensorineural function of the peripheral nerves. Of particular importance to this study is the genetic variant, CMT1E, characterized by an additional deafness phenotype. We hypothesize that a genetic defect in PMP22 causes abnormal regulation and expression of genes central to proper tissue development, that in turn accounts for the neuropathic phenotype and cochlear malfunction of CMT1E. PMP22 is a 22-kDa transmembrane protein that is highly expressed in neural tissue and to a lower extent in nonneural tissues at critical developmental time points. At least 61 point-mutations within PMP22 are linked to a neuropathology, 9 of which cosegregate with CMT1E and the deafness phenotype, and prove useful in defining structural properties of PMP22 important in cochlear function. Using the TrJ mouse model for CMT, we have isolated and characterized a set of cochlear genes that are differentially expressed relative to functional levels of PMP22. We quantified expression patterns of candidate genes with functions central to auditory development in nonneural tissues at ten prenatal and postnatal developmental points. With our findings, we developed a preliminary model of gene-interactions that may help explain the role of a PMP22 mutation in the development of auditory dysfunction.

Biological and Environmental Sciences, University of Tennessee at Chattanooga, Chattanooga, TN

P59 • Timothy Tedder, Timothy E. Shannon

Identification of Conotoxin Genes From the Cone Snail Conus pennaceus

Conotoxins are produced by large group of predatory marine snails, Cone Snails. This group of snails inhabit tropical reef environments throughout the world. They are categorized into three major groups based upon prey preference, 1) the piscivorous group prey upon fish; 2) molluscivorous group prey upon mollusk; and 3) vermivorous group prey upon polychaete annelids. All cone snails are venomous predators whose venom contains highly toxic peptides that immobilize and capture prey items. The toxic proteins are produced in long ducts and are stored in venom bulbs. It is estimated that more than 50,000 unique peptide sequences exist in cone snail venom. The cellular targets for these peptides include voltage and ligand gated ion channels and G-protein coupled receptors. Because of the large number toxins found in a single species of snail it is of interest to catalog the different toxin genes for each snail and predict the protein sequence in order to properly classify the toxins. Using conserved sequences in the signal sequence and the poly-A tail of mRNA to prepare primers, reverse transcriptase PCR was utilized to prepare cDNA of toxin genes. The potential genes were then sequenced. Analysis of the DNA sequence allowed for identification of open reading frames and putative peptides that could be compared to known conotoxin sequences.

Dept of Biology, Francis Marion University, Florence, South Carolina

P60 • Breanna Willeford, Sierra Willeford, Duncan Perry, Tianyi Wu, Fang Ju Lin

Effect of Grape Seed Extract in Fruit Fly Drosophila Huntington's Disease Model

Huntington's disease is a devastating neurodegenerative disorder, affecting 4-8 per 100,000 in U.S. population. Most patients show deficits in cognitive and motor function starting at age 35 to 45. Mutant huntingtin protein with polyglutamine expansion form protein aggregation which leads to cell death. It has been reported that grape seed extract (GSE; 2.8 μ g/ml) extends the lifespan of transgenic *Drosophila* carrying a mutant human huntingtin gene. In addition, GSE also improves motor function in the mouse Huntington's disease model. In this study, flies were subjected to a ten-fold concentration (30 μ g/ml) of GSE compared to previous report. The effects of GSE were observed on their motor function by climbing assay, as well as on their lifespan. The morphological change in fly brain was examined by immunohistochemistry. We aim to develop a valid screening using *Drosophila* for potential compounds that could slow down the progression of disease, as currently there is no cure for Huntington's disease.

Dept of Biology, Coastal Carolina University, Conway, SC

P61 • Gregory S. Barrett¹, Diana B. Ivankovic¹, Donna R. Weinbrenner^{1,2}

Effects of Crude Extracts Taken From Phytolacca americana on Differentiated PC12 Cells

Crude extracts taken from *Phytolacca americana* were tested on the neuronal morphology of the rat derived pheochromocytoma (PC12) cell line. The extracts were prepared using the Soxhlet extraction method with extraction times of 20-24 hours using methanol, deionized distilled water, and methylene chloride for solvents. Extractions were performed on separate plant materials which included leaves/stems, mature berries, and roots. These crude extracts were added to cell growth medium at varying concentrations then applied to the differentiated neuronal model (100ng/ml Nerve Growth Factor for 48 hours) of the PC12 cell line while being sub-cultured on 96 well ELISA plates coated with rat tail collagen type IV. Extracts were allowed to incubate for 48 hours before MTS cell viability assays were performed.

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P62 • Ombeni M. Idassi¹, Patrice Cagle¹, Ipek Goktepe³, Patrick Martin¹, Radiah Minor²

Rosehip Extracts Prevent Glioblastoma Cell Proliferation by Regulating Retinoblastoma Phosphorylation

Glioblastoma multiforme (GBM) are malignant tumors that arise in the brain. The current system of clinical management for GBMs consists of surgical resection followed by radiotherapy and chemotherapy. However, this treatment regimen has not improved the lifespan of GBM patients in the past twenty years and new therapeutic options are being aggressively investigated. Rosehip (Rosa canina) extracts have been used for centuries as alternative therapies. Recent studies demonstrate that rosehip extracts possess antitumor properties. Therefore, we tested the antiproliferative capacity of rosehip extracts against GBM cell lines. We hypothesize that human GBM cell lines exposed to rosehip extract will demonstrate lower rates of cell proliferation as a result of cell cycle regulation. The human GBM cell lines, U-251 MG and U-1242 MG were treated with rosehip extracts (1 mg/mL - 25ng/mL) and demonstrated a decrease in cell proliferation. Utilizing a fluorescent-based labeling strategy (Live-Dead Assay), we examined whether rosehip extracts prevented cell proliferation by initiating apoptosis. Pretreatment with rosehip extracts (1 mg/mL - 25ng/mL) induced the inhibition of cell proliferation without promoting apoptosis. Furthermore, we assayed the phosphorylation level of the retinoblastoma (Rb) protein to determine the mechanisms by which rosehip extracts were preventing cell proliferation. Rb phosphorylation was decreased following exposure to the rosehip extracts, suggesting the extracts prevent cell cycle progression beyond the G1 phase. Taken together, these data suggest that rosehip extracts inhibit cell proliferation via a cytostatic mechanism that prevents cell cycle progression

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P63 • Jamal Shuja¹, Shirley A. Vas¹, Vanessa Yanes¹, Michael Erwin

Haplotype Diversity Analysis of Black Crappie, *Pomoxis nigromaculatus* (Family Centrarchidae), Inhabiting Twofloridian Lakes

Molecular markers have been used to analyze the genetic structure of many pelagic fish populations. In this study haplotype diversity will be examined for the nuclear rhodopsin gene (RHO) and the mitochondrial cytochrome c oxidase I gene (COI) of *Pomoxis nigromaculatus*, Black Crappie, in Lake Sydney Lanier, Georgia. Data released by the U.S. Dept of the Interior indicates that *P. nigromaculatus* is the highly targeted freshwater fish in United States. This fishery has been sustainable due to the species' fecundity, monitoring by wildlife management, and enforced bag limits by the state. Data on the

genetic structure of this population may provide a useful tool for wildlife managers to more effectively manage this species. Mitochondrial DNA (mtDNA) and nuclear DNA (nuDNA) sequence data were collected for the purpose of developing an initial genetic baseline for black crappie inhabiting Lake Marion and East Lake Tahoe, Florida.

P64 • Bryan T. Zorn¹, Cara M. Santelli², Sarah K. Carmichael³, Chuck P. Pepe-Ranney⁴, Leah-Anne Roble⁵, Mary-Jane Carmichael⁶, Suzanna L. Bräuer¹

Illumina Sequencing of Fungi Associated With Manganese Oxide Deposits in Karst Systems

Fungi have been observed to produce external Mn(III/IV) oxides resembling buserite, birnessite, and todorokite. Although the exact evolutionary function and genetic trigger producing these oxides is unclear, they can influence the environment by aiding in the breakdown of recalcitrant carbon as well as offering a versatile protective barrier immobilizing other metals. In this study, native and manipulated microbial communities associated with manganese oxide deposits within two karst systems are compared and contrasted by using molecular techniques. While qPCR data of sampled sites indicate that fungi are present in relatively low abundance, diversity remains high. Using ultra-deep sequencing in conjunction with the QIIME pipeline, millions of paired-end fungal ITS1 amplicons have yielded a plethora of OTUs providing unprecedented insight into phylogenetic assemblages of this unique biome, as well as identifying many genera of known manganese oxidizers that may be contributing to said deposits such as *Acremonium, Cladosporum, Mortierella, Pleospora*, and *Pyrenchaeta*.

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P65 • C. Ronnie Funk¹, Melanie May², Anna Blenda¹, Charles E. Schwartz²

Investigation of the Molecular Basis of Split Hand-Foot Malformation in a Family by Whole Exome Sequencing (WES)

Split hand foot malformation (SHFM), ectrodactyly, is a limb malformation disorder that involves the central rays of the hands and feet. People with SHFM can exhibit syndactyly, median clefts of the hands and feet, and aplasia or hypoplasia of the phalanges, metacarpals, and metatarsals. While several chromosomal loci have already been associated with SHFM, the molecular basis of SHFM remains unknown in some families. In order to determine the etiology of SHFM in a family without mutations in known SHFM genes, genomic DNA of some family members was subjected to whole exome sequencing (WES), The data was filtered to identify gene alterations that were novel, not present in normal databases. Based on this analysis, missense mutations in three genes, MAP1B. NEK1, and CHD6 were selected for further analysis. Segregation analysis of the mutations in the family initially indicated that only the change in MAP1B might be relevant to the phenotype. Unfortunately, the follow up analysis of twins, one of which was clearly affected, born to an affected male, failed to provide segregation of the MAP1B mutation. As a result, none of the three gene alterations detected by WES were found to be associated with the SHFM phenotype in the family. The data is being re-analyzed to determine if other potential mutations exist which can be pursued in the family.

P66 • Sarah Brown, Marlee B. Marsh

Further Characterization of Mab 2C11 (Eosinophilic Granular Cell) in Intestinal Tissue of Fish From Saluda Shoals Park, Columbia, South Carolina

Host-parasite immune responses of higher vertebrates are often mediated through Th_2 cells, resulting in the secretion of IL-5, eosinophilia, and immunoglobulin class-switching to an IgE. Host-parasite interactions in fish are one of the least understood areas of

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comparative immunology, mostly because immunoglobulin class-switching does not occur in fish, and evidence for Fc receptors on phagocytes is unequivocal at this time. However, the presence of eosinophilic granular cells (EGCs) in some species of fish suggests that there may be a role for these cells in the immune response to parasites. In this study, monoclonal antibody (mAb) 2C11 has been developed against a protein found only in highly granulated cells that may be equivalent to eosinophilic granular cells (EGCs) found in various species of fish. Several species (E.g. Lepomis spp., Ictalurus spp. and Micropterus spp.) of freshwater fish (n=41) were collected from Saluda Shoals Park, Columbia, South Carolina, necropsied and examined for parasites. All abdominal tissues were collected and preserved. mAb 2C11 was used to probe paraffin-embedded intestinal tissues from fish. Differences in EGC profile of parasite infected and non-infected fish are described.

Columbia College

P67 • Martha Molina-Sanchez, Marlee B. Marsh

Immunohistologic Examination of Host-Parasite Relationships in Gill Tissue of Teleosts From Saluda Shoals Park, Columbia, South Carolina

While immunologic responses of mammals to parasites have been well documented in the literature, and generally include eosinophils and the secretion of IL-5 and IgE, there is no good immunoparasitology model that exists in fish. Initial studies of the fish eosinophilic granular cell (EGC) have demonstrated their involvement in parasite responses, making these cells a logical focal point in understanding fish immunoparasitology. Fish (Ictalurus spp, Fundulus spp, etc.) are commonly used as models in comparative immunology labs, but the underlying problem with advancing the knowledge of immunoparasitology in fish is a lack of suitable reagents to characterize cell types and general immune responses against parasites. We recently developed a monoclonal antibody (mAb) 2C11, which recognizes a protein found only in highly granulated cells that may be equivalent to EGCs found in various species of fish. Since EGCs may function like eosinophils of higher animals, this antibody reagent may be useful in identifying some of the roles of EGCs in fish-parasite interactions. Several species (E.g. Lepomis spp., Ictalurus spp., and Micropterus spp.) of freshwater fish (n=41) were collected from Saluda Shoals Park. Columbia, South Carolina, necropsied and examined for parasites. All gills were collected and preserved. mAb 2C11 was used to probe paraffin-embedded gill tissues from fish. Differences in EGC profile of parasite infected and non-infected fish are described.

Columbia College

P68 • Whitney Smith, B. Carolina Gallango-Bruns, Troy Mutchler, Thomas McElroy

Spatial Delineation of Monoclonal Genotypes in the Seagrasses *Thalassia testudinum* and *Halodule wrightii* In the Gulf of Mexicos Florida and Alabama Coastlines

The genetic diversity of the seagrasses Thalassia testudinum and Halodule wrightii collected from three locations (St. George Sound, FL; St. Joseph Bay, FL; and Grand Lagoon, FL) was estimated using microsatellite markers. The objective of this preliminary study was to measure the extent of monoclonal genotypes within sampled sites and to estimate gene flow among sampled sites for the two species. Seagrass tissue samples were collected at 10 meter intervals along 100 meter transects. The tissues were preserved in silica gel and transported to Kennesaw State University. Genomic DNA was isolated from plant tissue using MOBIO DNA Extraction Kit for plant tissue. Six microsatellite loci for each species were amplified. The amplified samples were electrophoresed using an ABI 310 automated DNA sequencer. The allele sizes were estimated compared to an ROX 500 size standard and the genotypes assigned. Allelic diversity was detected within loci, among individuals, within sites and between sites indicating site specific genetic differences. Monoclonal genotypes ranged from 10 to 100 meters for the two species and varied within and between sampled sites. The observed patterns of genetic diversity and the natural barriers and corridors of recruitment in this system for these species will be interpreted in the context of natural and anthropogenic impacts on seagrass beds. Knowledge of this type will enhance the ability of researchers to predict if and how this species and others will respond to changes in hydrology and disturbance, and the impact these changes may have on community structure.

Kennesaw State University

P69 • Amy Herbert, Kristen Oliver, Jennifer S. Borgo

Scat Composition of Coyotes in Carolina Sandhills National Wildlife Refuge, South Carolina

Coyotes (Canis latrans) have recently become a widespread predator in South Carolina. however foraging behavior in the Southeastern United States has not been studied extensively. We have explored coyote diet over the past four years at Carolina Sandhills National Wildlife Refuge, South Carolina. Since May 2010, coyote scat was collected into paper bags from roads and trails in the refuge. The bags were labeled with the date and location of collection. The scat was then taken back to Coker College and placed in a freezer until processing. Before dissection, scat was dried in an oven for three days at 65°C. Over 239 samples have been collected since May 2010. Of those samples, just under half have been dissected. We found evidence of heavy predation on mammal species. Mammal remains make up the highest composition in scat, at 46.2% of scat mass, followed by plant remains (39.6%), arthropods (7.8%), and, lastly, avian remains (1.7%). Although plant remains did not make up the largest composition of individual scats, they were found in every dissected scat. Mammal remains were found in 81.9% of scat. Arthropods were also quite abundant, found in 77.1% of scat. Avian remains were quite rare, found in only 9.6% of scat remains. Future studies in this area should evaluate the relationship between prey availability and consumption to determine if coyotes are showing any dietary preferences.

Coker College, Hartsville, SC

P70 • Brenee' L. Muncy, Christopher D. Barton, Steven J. Price

The Effects of Mountaintop Removal Mining and Valley Fills on Stream Salamander Communities

Mountaintop removal mining and valley filling (MTR/VF) is the most common form of land conversion in Central Appalachia and threatens the integrity of stream ecosystems. We investigated the effects of MTR/VF on stream salamander occupancy probabilities and overall community structure by conducting area constrained active searches for stream salamanders within intermittent streams located in mature forest and those impacted by MTR/VF. During the spring and summer of 2012, we detected five stream salamander species (Desmognathus fuscus, D. monticola, Eurycea cirrigera, Pseudotriton ruber, Gyrinophilus porphoriticus) and, using a hierarchical Bayesian analysis, found that occupancy probability was greatly reduced in MTR/VF streams compared to control sites. Additionally, the salamander community was greatly reduced in MTR/VF streams; species richness estimates for MTR/VF streams was approximately 2.1 (± 0.5 s.e.), whereas richness was 4.8 (± 0.2 s.e.) at control streams. Numerous mechanisms may be responsible for decreased occupancy and diminished salamander communities at MTR/VF streams; though water chemistry at field sites may be a particularly important mechanism. Indeed, we detected elevated levels of conductivity, pH, and dissolved metals and solids in MTR/VF streams. Our results indicate that salamander communities, along with many invertebrates, fish, and other aquatic and/or semi-aquatic animals, are extremely susceptible to MTR/VF mining practices.

Dept of Forestry, University of Kentucky, Lexington, KY

P71 • Joel M. Gramling, Zachary J. Brownlee

The Short Term Effects of Laurel Wilt on Native and Non-Native Coastal Plant Species

Laurel Wilt is a disease caused by a fungal pathogen that is thought to have been introduced to the United States from eastern Asia. The primary vector for Laurel Wilt, the redbay ambrosia beetle, was first collected at Port Wentworth near Savannah, Georgia in 2002. In the last 12 years the disease has spread across the southeastern United States

affecting numerous species in the Lauraceae plant family. In 2008, vegetation plots were established along coastal North and South Carolina to monitor the progression of this disease as it moved up the Atlantic coast and to quantify changes in coastal plant communities. Analysis of plot data collected annually (2008-2013) has indicated that the disease is significantly more likely to affect larger diameter stems (> 5 cm) than smaller diameter stems (> 5 cm) of lauraceous plants. Additionally we have quantified changes in basal area and stem number of plant species in coastal plant communities of the Carolinas. Our results suggest that the short term effects of Laurel Wilt are not facilitating an increase in invasive species abundance or establishment. Instead, native plant species already present in the plant communities are occupying spaces that are no longer being taken up by lauraceous plants whose number and biomass have been significantly reduced by Laurel Wilt.

Dept of Biology, The Citadel, Charleston, SC

P72 • Trent D. Smith, Timothy O. Menzel

An Investigation of Possible Mechanisms Behind the Behavioral Responses of Aphaenogaster carolinensis to Other Ant Species

Previous studies have shown interspecific interactions involving Aphaenogaster carolinensis vary depending upon the identity of the other species involved. The specific behaviors of A. carolinensis during these interactions have not be investigated. This behavior was isolated during field observations of A. carolinensis on bait cards containing a food sources and one of three other ant species or no ant control. Two sets of variables were quantified from video recordings of these observations. The first set was collected at the bait card level and included angular distances from entry to exit and from both entry and exit to treatment (specimen or empty control), time on bait, distance traveled and average speed. These were analyzed together for a nonrandom relationship with treatment using a Multiple Response Permutation Procedure (MRPP). The second set of variables, at the within bait level, included speed at specific points on baits and distance to treatment from those points. Effect of treatment on speed, the relationship between distance to treatment and speed, and the interaction between treatment and distance were analyzed using ANCOVA. The relationship between bait card level variables and treatment was not different from random (ObservedDelta=0.3999, ExpectedDelta=0.3963, p=0.5242). The within card relationship between treatment and speed was significant (df=3, F=5.763, p=0.0009) while the effect of distance to treatment (df=1, F=0.427, p=0.5142) and the interaction between distance and treatment (df=3, F=2.148, p=0.0962) were not. We conclude that A. carolinensis' behavior within the spatial area of baits may depend on the species they are in contact with.

Dept of Natural Science, Piedmont College, Demorest, Georgia

P73 • Megan E. Gibbons¹, Karen M. Warkentin², Jennifer Stynoski³

Genetic and Non-Genetic Factors Influence Development and Behavior of Red-Eyed Treefrogs

Plasticity in transitioning from one life stage to the next can be adaptive for species with complex life-cycles, particularly if conditions across life stages are unpredictable. Genetic and non-genetic maternal effects may influence the outcome of the niche shift, with responses varying between individuals. The red-eyed treefrog (*Agalychnis callidryas*) is an excellent study organism for investigating genetics and life-stage switch point timing because embryos exhibit adaptive phenotypic plasticity in hatching time and females deposit multiple clutches of eggs in a single reproductive event, allowing for manipulation of mates. In this study, we investigated the how hatching time, maternal effects, and paternal (i.e., genetic) effects influence antipredator behavior and development of tadpoles, and developmental traits of metamorphs, including larval period, body size, and jumping ability. There were no maternal or paternal effects on tadpole behaviors in antipredator trials, although hatching time influenced some of the behaviors. Early-hatched tadpoles were significantly larger than late-hatched tadpoles 21 days after

oviposition, and tended to have shorter larval periods. There were significant maternal and paternal effects on developmental traits of metamorphs, and several traits in which a significant interaction between maternal and paternal effects suggests genetic dominance. As additional evidence for maternal effects, we found that offspring of females that produced larger eggs had shorter larval durations, were larger at metamorphosis, and had longer jumping distances. This study indicates the potential importance of single early-life events on subsequent life stages and that some of these effects are dependent on maternal and genetic factors.

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P74 • Nick W. Spalsbury, Jim Welch, Richard Phillips

Preliminary Genetic Evidence of Hybridization in a Sympatric Population of Southern and Northern Cricket Frogs

Amphibian declines are well documented and are often associated with multiple anthropogenic as well as natural factors. One consequence of alterations in species' habitat may be the increased probability of hybridization. Although pre-reproductive barriers in Anurans are well-documented, studies suggest declines in several species of Cricket Frog yet few examine possible hybridization in areas of sympatry. In spring of 2012, we began examining a sympatric population of Northern (Acris crepitans) and Southern cricket frogs (A. gryllus) from northern Mississippi. Identification using morphological features presented in previous works suggests a large presence of hybrids, with very few individuals exhibiting character sets indicative of a single species, particularly of the northern variety. However, identification of these species by morphology may not be diagnostic causing character scores to become problematic. Using 4 established nuclear markers, we assigned animals to one of three categories; northern, southern, or hybrid. We present data and preliminary analysis from cricket frogs collected from the same location during the spring of 2012 and summer of 2013. Based upon morphological data, proximity of habitation, and the influence of environmental factors, we predict high numbers of hybrids and few pure individuals of either species.

Wittenberg University

P75 • Kristen Oliver¹, Jennifer S. Borgo¹, Rebecca Heiss²

Bacterial Growth Inhibition of the Uropygial Glands Secretions of Passerines in South Carolina

We examined whether secretions of the uropygial gland inhibit growth of the feather degrading bacterium Bacillus licheniformis or E.coli differently depending on environment. Birds were mistnetted monthly at three trapping sites located near Hartsville (inland), Georgetown (coastal), and Awendaw (coastal), SC from May to August, 2013. Captured birds were identified to species, and uropygial samples were collected and placed in solutions of PBS. Bacterial assays were conducted using techniques modified from French and Neuman-Lee (2012). Using a 96-well plate, each sample was distributed into 4 wells. B. licheniformis was added to two of those wells. E.coli was added to the other two. After incubation, dilution series were prepared for each well, and samples were plated onto TSA. The plates were incubated overnight and counted. The average growth inhibition of B. licheniformis for all samples was -6902% indicating an increase in reproducing colonies. However, values ranged from -219344% to >99%. No significant differences were found in the ability of gland secretions to inhibit growth of either bacterium when comparing between coastal and inland birds or between the sexes. Finally, no correlation was found in the ability of uropygial secretions to inhibit growth of B. licheniformis and E.coli (r=-0.27, P=0.15). Individuals within a species differed appreciably in their abilities to inhibit the growth of B. licheniformis and further investigation is necessary to determine the reason for this variabilty.

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P76 • John F. Darling, Alanna M. Wentworth, Lauren A. Ballou, Sophia Almammary, Christopher A. Adams

A Study on the Seed Germination Ecology and Seedling Survivorship of the Endangered Cream Gentian Gentiana flavida

Gentiana flavida is an endangered species in Kentucky, with populations known from only five counties. Little is known about the life history of this species. The purpose of this project was to examine the initial stages of the species' life history; seed germination and seedling survivorship. Initial tests determined that the seeds are dormant at maturity. This study attempted to discover the proper dormancy-breaking conditions for maximum seed germination and to determine the necessary growth medium for maximum seedling establishment. Mature seeds were placed in a 5° C incubator for varying time periods (0-12 weeks), simulating the cold stratification that seeds would receive in the field during winter. Next, each group of seeds was moved to a 25° C incubator and germination was monitored. To determine ideal growth medium conditions, G. flavida seedlings were placed in three different soil treatments (mychorrizal inoculated, non-mychorrizal, and soil from the field site) and then monitored over time for survivorship. Results indicated that the 12 week cold stratification treatment produced a significantly higher percent germination (73%) than stratification at 8 (61%), 4 (8%), or 0 (0%) weeks. Among the growth medium treatments, soil collected from the field site contained seedlings with the highest seedling survivorship (67%), significantly higher than the other two treatments. Potting media that contained mychorrhizal inoculants showed higher survivorship (38%) than media that was not inoculated (2%). In conclusion, for maximum germination and juvenile survivorship, seeds should receive 12 weeks of cold stratification and have exposure to mychorrizal soil microbes.

Dept of Biology, Berea College, Berea, KY

P77 • Gregory D. Hartman, Michael J. Bender

New County Records of Bats From West-Central Georgia

A lack of data on the presence or absence of species hampers the ability of biologists and wildlife professionals to assess the status of many mammal populations in Georgia, including bats. Prior to 2011, there were published records of the occurrence of only two species of bat, *Lasionycteris noctivagahs* and *Nycticeius humeralis*, from within an area encompassing 18 contiguous counties and more than 5,745 square miles in west-central Georgia; both records were for Lamar County. Using roosting-site surveys, mist-netting, and salvage, we are conducting an ongoing study to document bat species richness in west-central Georgia. Thus far, we have documented the occurrence of the following within the 18-county region: *Tadarida brasiliensis*, *Eptesicus fuscus*, *Lasiurus borealis*, *Lasiurus seminolus*, *Myotis austroriparius*, *Nycticeius humeralis*, and *Perimyotis subflavus*.

Dept of Biology, Gordon State College, Barnesville, GA

P78 • Peter Schafran¹, Joseph Keenan¹, Marcus Jones², Lytton Musselman¹

 ${\it In~Vitro}$ Seed Germination and Development of ${\it Calopogon~pallidus}$ (Orchidaceae) From Virginia

Calopogon pallidus Chapm. is a plant of pine savannahs and grasslands in the southeastern US. It is rare (S1-S3 ranking) in four of the eight states Atlantic and Gulf states where it is found. County level distribution maps show populations are patchy with several disjunctions; the sole Virginia population is disjunct from its nearest neighbor in Beaufort County, NC, by approximately 130 miles. In Virginia, *C. pallidus* occurs in one location within an area of about 25 m². Seeds from this population were collected in September 2013 and sown on four different commercial growth media (P723 Orchid Seed Sowing Medium, Knudson C Orchid Medium, BM-1 Terrestrial Orchid Medium, and Knudson C Modified Plus Orchid Medium; *n*=11) in November. After 14 days, germination occurred in 100% of flasks that were not contaminated with mold. At 6 weeks, shoots

formed in three of the media; P723 had significantly higher numbers of shoots per flask than all others (x=23.7; p<0.005). Shoot and root growth will be measured as the orchids develop. While the Virginian *C. pallidus* population is currently stable and growing, it is small and could be destroyed without proper habitat management. The ease of seed germination in culture provides a way for this rare orchid to be cultivated and distributed, preserving the species' northernmost genotype.

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P79 • Kristin Emery, Jennifer Rhode Ward, H. David Clarke

Effects of Open Pollination, Selfing, Inbreeding, and Outbreeding Treatments on Seed Set and Viability in *Spiraea virginiana* Britton (Virginia Spiraea), an Endangered Rose

Spiraea virginiana Britton (Virginia spiraea), an endangered riparian shrub found in the Appalachian and Blue Ridge Mountains, reproduces primarily via asexual reproduction. Sexual reproduction is rare under natural conditions, but it is unclear whether pollen limitation or genetic incompatibilities are the underlying cause. Open, selfed, inbred, and outbred pollination treatments were applied to populations of S. virginiana in three Western North Carolina counties. In addition, stigmas from open pollinated treatments were collected to quantify pollen loads. Flowers from pollination treatments were collected 90-120 days later, and a subset of seeds were stratified for three months before testing germination rates. In addition, 100 seeds from each replicate were tested for viability using TTC. Both foreign and conspecific pollen loads on Graham County stigmas were significantly lower (P = 0.0001) than pollen loads on stigmas from other populations. Seed set from Ashe County plants was significantly lower than other populations (P = 0.0001), but treatment had no significant effect on seed set (P=018). Because seed set was not correlated with pollen load, variation in reproductive success could be due to other factors. We are currently investigating genetic variation within and among populations to see if that could explain differential seed production.

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P80 • Joshua F. Hashemi, Paula C. Jackson

Arbuscular Mycorrhizal Fungal Colonization in the Black Willow (Salix nigra) and American Sycamore (Platanus occidentalis)

This project is part of a larger investigation to examine the suitability of using American sycamore (Platanus occidentalis L.) in addition to, or as an alternative to black willow (Salix nigra Marshall) in riparian restoration. Of the two species, only one, black willow, has been used extensively in riparian restoration. The purpose of this aspect of the research was twofold: 1) to compare arbuscular mycorrhizal fungal colonization in the two riparian tree species; and 2) to compare the efficacy and complexity of two potential staining methods. In order to determine the difference, if any, in the level of mycorrhizal colonization among the two tree species we first compared the efficacy of two different stains in mycorrhizal identification: trypan blue and acid fuchsin. Results from staining methods were compared employing both compound microscopy and laser scanning confocal microscopy (Zeiss LSM 700). Quantification of arbuscular mycorrhizal colonization in root samples was calculated using the root piece method. Root samples were taken from trees of different diameter growing in a riparian area within a patch of forest on the campus at Kennesaw State University in Kennesaw, Georgia. Preliminary results suggest mycorrhizal fungal colonization is higher in the sycamore (Platanus occidentalis) root samples

Dept of Biology and Physics, Kennesaw State University, Kennesaw, GA

P81 • Matthew Dye, Dr. Tamara Johnstone-Yellin, Timothy Kreps, Tim Stamps, John Rohm

Effects of Climate Patterns on White-Tailed Deer (Odocoileus virginianus) Antlers on Quantico Marine Corp Base

Climate can affect the growth of vegetation in white-tailed deer habitats, in turn affecting the nutritional status of deer. Because antlers also indicate the overall health of the individual white-tailed deer, variation in weather from year to year could result in a measureable difference in the antler growth. We analyzed the effects of weather on antler growth of all white-tailed deer harvested from 1983-2012 from 20,234 ha of hunting grounds at Quantico Marine Corp Base, Virginia. We analyzed the right beam diameter at the base and right beam length measured for each antlered buck taken against heating degree days (Dec. 1-Feb), growing degree days (March 1-Aug. 15), and precipitation levels (March 1-Aug. 15) prior to harvest. We found a correlation between overall antler growth and the weather prior to and during each antler growing season with variation among age classes. Wildlife managers could use the relationship between weather and antler growth as a predictive tool for harvest management and as an indirect measure of habitat health.

Bridgewater College; ² Bridgewater College; ³ Bridgewater College; ⁴ Quantico NREA; ⁵ Quantico NREA

P82 • Susie C. Masecar, Amanda J. Chunco

Effects of Agricultural Practice on Mammal Diversity

Wildlife habitat is increasingly being converted to agricultural land to meet the demands of a growing human population. Determining how different agricultural practices will influence biodiversity is thus critically important. Although significant literature has explored the relationship between farming practices and insect diversity (particularly for pests and pollinators) less work has focused on the impacts of farming practice on vertebrate species. We are investigating the relationship between specific agricultural practices (including pesticide use, farm size, and crop diversity) and mammal biodiversity (measured through species diversity, abundance, and Shannon Index) on farms throughout the Piedmont of NC. We are collecting mammal samples from fifteen farms in Central North Carolina. Twenty Sherman live traps and three Bushnell Trophy Cams will be used at each site to measure both small and large mammal diversity. We have collected preliminary data from two study sites, but will continue sampling through June 2014. Sampled species to date include the white-footed mouse, hispid cotton rat, whitetailed deer, and Virginia opossum. Results will be analyzed using a MANOVA. Use of pesticides is anticipated to be correlated with lower mammal diversity, and high crop diversity with the higher mammal diversity. Results aim to inform future agriculture in a direction that facilitates the greatest natural biodiversity, thus preserving ecosystem services. Due to its demonstrated interest in boutique agriculture, North Carolina is excellent candidate for applying this study's findings.

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P83 • Heather M. Joesting¹, Patrick D. Biber²

Potential Use of Shrimp Biofloc Solids as an Alternative Fertilizer in Coastal Salt Marsh Plant Nursery Production

The large nutrient inputs required to support high stocking densities in shrimp culture contributes to the accumulation of biofloc particles. Although these particles are beneficial to shrimp and nutrient cycling, management of biofloc concentration has been shown to significantly enhance shrimp production. To increase sustainability and investigate the potential for supporting an additional crop, a means of nutrient reclamation from removed biofloc should be considered. This study examines the potential use of shrimp biofloc solids as fertilizer for the production of salt marsh plants used in coastal restoration. Spartina alterniflora and Juncus roemerianus individuals were maintained in a greenhouse and assigned to one of three weekly dosing treatments for a six week dosing period: (1) control with no nutrient additions (2) addition of Miracle-Gro™, and (3) addition of dried, ground biofloc solids. Plants were measured at the end of the dosing period and approximately three months after the final dose (response period) for plant biomass and tissue nutrient content, and control plant productivity was compared to Miracle-Gro™ and

shrimp biofloc solids independently. Results indicated that although shrimp biofloc solids had ~2.5 times greater total nitrogen content, plants treated with Miracle-Gro™ had greater overall plant productivity compared to the control than biofloc solids in both dosing and response periods. However, increased plant biomass and tissue nutrients in plants treated with shrimp biofloc solids compared to the control did suggest fertilization potential for shrimp biofloc solids in nursery production of salt marsh plants.

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P84 • Kristen S. Gillespy, Emily S. Rademacher, Maximilian M. Kern, Leigh Anne Harden, Shannon E. Pittman, Michael E. Dorcas

Factors Affecting Detection Probability of Spotted Salamanders (Ambystoma maculatum)

Monitoring wildlife populations using mark-recapture is valuable for estimating population size and structure. Information about population statistics is critical for amphibian conservation, which is important for sustaining diverse ecosystems. However, factors affecting detection probability can skew population size estimations and measures of other demographic parameters. We used the spotted salamander (Ambystoma maculatum), a cryptic wetland amphibian, as a model species to investigate factors affecting detection probability. Secretive wetland species that use aquatic habitats to breed are ideal organisms for mark-recapture studies because a large portion of the population arrives at one centralized location to reproduce. Additionally, wetland species serve as indicators of wetland ecosystem health. We monitored A. maculatum entering and exiting a 0.5 ha ephemeral wetland in the North Carolina Piedmont area using 40 aquatic funnel traps and a 400 m drift fence containing 76 terrestrial pitfall traps spaced 10 m apart positioned on both the inside and outside of the fence. Traps were checked daily during January and February 2013 and 2014. Individuals were identified using elastomer codes and an individual spot recognition code system. We used program MARK to investigate factors (e.g. sex, trap type, and behavioral response to traps) that affect detection probability and contribute to imperfect detection. We constructed candidate models that included these factors as covariates and used AIC to evaluate the most parsimonious models. Our findings suggest that it is important to consider various factors affecting detection probability when assessing population demographics of a secretive species.

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P85 • Gregory Raymond, Jennifer Boyd

How Do Light Availability and Soil Characteristics Affect Growth and Reproduction of *Platanthera integrilabia* (White Fringeless Orchid)?

Platanthera integrilabia (white fringeless orchid) is a candidate for protection under the Endangered Species Act. At present, this species is known from ~50 scattered occurrences located primarily on the Cumberland Plateau. Historically, P. integrilabia occupied a much wider range than at present, and both habitat loss and its exhibited low levels of flower and seed production have been cited as major threats to the species. It has been suggested anecdotally that P. integrilabia requires a critical light intensity to elicit flowering; but that too much light could desiccate its moist habitat via evaporation. To support P. integrilabia conservation and management, we are investigating the influence of light availability and soil conditions on its growth and reproduction. During summer 2013, we collected preliminary data from a forested seep on Starr Mountain in the Cherokee National Forest, TN, which houses the largest known P. integrilabia occurrence. There, we found no correlation between the spatial distribution of reproductive individuals and microsite variability in light availability, soil moisture, or soil pH. However, the distribution of vegetative Plantanthera spp, was correlated significantly and positively with soil pH. These findings contrasted previous assumptions about the importance of light and soil moisture to P. integrilabia. However, it is important to distinguish between the withinsite variability that we measured and variability that could occur in these conditions across

sites. We will investigate this variability during summer 2014 across four occurrences in KY and TN.

University of Tennessee at Chattanooga

P86 • T. Shearman¹, P. Ma¹, J. Nankaya¹, H. Valdetero¹, S. Hart¹, H. Yun¹, D. Hagan¹, E. Mikhailova¹, W. Bridges²

The Role of Soil and Landscape Factors in Chinese Privet (*Ligustru sinense*) Invasion in the Appalachian Piedmont

There is a limited understanding about the ecological mechanisms that enable certain plant species to become successful invaders of natural areas. This study was conducted to determine the soil and landscape characteristics that correlate with invasion of Chinese privet (CHP), and to develop a model to predict the probability of CHP invasion in Piedmont forests. A Landscape Ecosystem Classification (LEC) system - based on the % clay in the B horizon, depth to maximum clay (cm), exposure, terrain shape, and aspect (degrees) - was used to determine the soil moisture characteristics of invaded and uninvaded plots. Additional measurements included the cover classes of CHP and other species, litter depth (cm), slope (degrees), overstory basal area (m2 ha-1), and soil chemical properties. When CHP cover exceeded 60%, other understory species were largely absent. CHP invasion was negatively correlated with overstory basal area and slope and positively with litter depth and pH. A stepwise logistic regression model containing these four variables was highly sensitive, with an overall accuracy of 78%. Given the accuracy of this model, we propose that it can be used to calculate the probability of invasion in a given area, provided that some basic, readily obtainable site characteristics are known.

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P87 • Leslie Russo, Callie Montgomery, Danny Hoover, Jared Odell, Gregory Raymond, Jennifer Boyd

Invasive Plant Species Distribution and Abundance in Tennessee Army National Guard Volunteer Training Sites &Ndash; From Ground Surveys to Geographic Information System Layers

We are conducting extensive ground surveys toward generating Geographic Information System (GIS) maps depicting the distribution and abundance of invasive plant species in Tennessee Army National Guard (TNARNG) Volunteer Training Sites (VTSs). These maps will provide a useful baseline tool for understanding how disturbances associated with military training could influence species invasions and for elucidating the potential impact of invasive species on rare ecological communities and native plant species through habitat overlap. Field surveys of 33 invasive plant species across 1600 ha were completed at the Catoosa County, GA and Milan, TN VTSs during summer 2013. Established methods for rapidly surveying large areas with small minimum units were employed. Preliminary data show that the most common non-woody invasive species include Lonicera japonica (Japanese honeysuckle), which occurs in 75% of all plots surveyed to date; Microstegium vimineum (Japanese stiltgrass), which has a frequency of 70% in Milan plots; and Lespedeza spp. (Chinese and bicolor lespedeza) which have combined 40% frequency in Milan plots. The dominant invasive woody species in all plots surveyed to date was by far Ligustrum spp. (common and Chinese privet) with a combined 40% frequency. Our observations suggest that the frequency of these and other invasive species is negatively correlated with distance from habitat edges.

University of Tennessee at Chattanooga

P88 • Brian L. McPherson

Disturbance Gives Rise to Biodiversity Along the River Margins of the Mobile-Tensaw Delta

My research is focused on the community response to natural and anthropogenic disturbance. My overarching goal is to better understand how habitat degradation and

disturbance influence competitive outcomes, long-term survival of native species, and the maintenance of ecosystem integrity. In addition to being disturbance-prone, the Mobile-Tensaw Delta MTD resides in the East Gulf Coastal Plain and is an excellent model for testing the Intermediate Disturbance Hypothesis, which implies that disturbance increases biodiversity. Specifically, my thesis research is focused on the effects of rainfall and flooding events that vary in duration, periodicity, and intensity, on plant community composition and diversity, and the prevalence of invasive species in flood zones along north-south and east-west gradients in the MTD to answer: Q1 How does community structure change along geographical gradients in the MTD? Q2 Do invasive species show any accelerated growth rates compared with native vegetation in respect to disturbance? I am utilizing protocols from North Carolina Vegetation Survey (NCVS) while sampling twelve 20 m x 50 m plots set along latitudinal and longitudinal gradients within the MTD. Percent cover per species is recorded for canopy, sub-canopy, and herbaceous layers for the entire plots and more intensive multi-scaled modules. Thus far, this project has identified 208 plant species including: 1) one county record and the first observation of Justicia americana (L.) Vahl in Baldwin County, AL. 2) the first record of occurrence for the non-native invasive plant, Colocasia esculenta, and 3) twelve additional plant species that have achieved invasive status in the MTD.

University of South Alabama Dept of Biology

P89 • Jane K. Marlow¹, John B. Nelson²

Under the Radar and on the Move: Ficaria verna A Threat to the Southeast's Riparian Areas

Ficaria verna, formerly known as Ranunculus ficaria and commonly called fig buttercup or lesser celandine, is reported to be invasive in the Northeast and Northwest. It is a plant that is relatively new to southeastern flora and unknown to most of us; nevertheless, it is quietly naturalizing in the Southeast and poses a serious ecological threat to riparian areas. It emerges early before most natives and is gone by June. This short growth cycle offers limited opportunity to spot it and a short window in which it is vulnerable to treatment. It thrives in mesic environments, typically on the banks of rivers, streams, lakes and ponds, as well as in wetlands. Once established it creates extensive, continuous, dense vegetative mats too thick for natives to penetrate. It has multiple reproductive strategies: Four of the five subspecies produce viable seed; two can reproduce via their numerous axillary bulbils; all have sturdy underground tubers that can make new plants if separated from the parent. Bulbils and tubers are easily spread by water events (and wellmeaning weed-pullers). It is a landscape plant that is still available commercially and is often confused with marsh marigold, Caltha palustris. Many of the sites where it has naturalized are downstream from landscape plantings, and evidence indicates that these sites are more extensive and widespread than might be surmised from available range maps.

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P90 • Charles A. T. Jackson, Justin L. Hart

Potential Impact of Emerald Ash Borer on Forest Composition in Alabama

Emerald ash borer (*Agrillus planipennis*; EAB) is beetle native to Asia and eastern Russia. EAB was first discovered in the US in 2002 in Michigan and it has since spread to 21 states and killed tens of millions of ash (*Fraxinus* spp.) trees. EAB-induced mortality of ash will result in localized canopy disturbances that will in turn impact forest composition, structure, and function. To examine the potential effects of widespread and sudden ash mortality in Alabama forests, we used USDA Forest Inventory and Analysis (FIA) data in a geographic information system environment. We hypothesize the loss of ash in Alabama to be minor at the state-level, but to be locally important for stands that have relatively high ash density. We used the most recently completed FIA survey for Alabama to identify and spatially reference ash trees (*F. americana*, *F. pennsylvanica*, and *F. quadrangulata*) in the dataset. Field studies have indicated ash mortality in untreated, infested stands to

be > 99%. Therefore, in our analysis we assumed death of all ash trees. We used tree diameter to estimate the size of canopy gaps created by the loss of canopy ash and classified all gaps as small or large. We then calculated the relative importance values (RIV) separately for overstory and understory taxonomic groups. On a per plot basis, we assumed the overstory species group with the highest RIV would capture small canopy gaps and the understory species group with the highest RIV would capture large canopy gaps created by ash mortality.

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P91 • Lauren E. Cox, Justin L. Hart, Michael K. Steinberg

Pre-European Settlement Forest Composition and Structure of the Alabama Fall Line Hills

General Land Office (GLO) surveys are archives that contain quantitative and qualitative descriptions of pre-European settlement forests, and were used to map lands in the United States beginning in 1812. Data obtained from original GLO surveys provide information necessary to construct models of pre-settlement forests, which are useful for establishing place-based targets for land management. We used GLO surveys from 1820 and 1842 to reconstruct the pre-settlement forest in the Fall Line Hills of west-central Alabama, Using witness tree species and location, we analyzed relative frequencies and densities to determine the compositional characteristics of the forest at various topographic positions. Pine (Pinus spp.) composed 55% of the total forest composition, and accounted for 30% of the forest composition at lower slopes, 54% at North and East facing slopes, 72% at South and West facing slopes, and 73% at upper slope positions. Altogether, oak (Quercus spp.), hickory (Carya spp.), and chestnut (Castanea denata) comprised 27% of total forest trees. We estimated total density of pre-settlement forest to be 370 stems/ha. Results from this analysis provide a basis for the quantitative comparison between current management regimes used for longleaf pine (Pinus palustris) and the pre-European settlement forest conditions and can be used to set desired future conditions for restoration on public lands.

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P92 • Stephen D. White¹, Justin L. Hart¹, Callie J. Schweitzer², Daniel C. Dey³

Intermediate-Scale Wind Disturbance Affecting the Development and Succession of Southern Appalachian Quercus Stands

Natural disturbances play important roles in shaping the structure and composition of all forest ecosystems and can be used to guide silvicultural practices. Disturbance intensity is measured along a gradient ranging from highly localized, gap-scale events to standreplacing events. High wind storms such as downbursts, derechos, and low intensity tornadoes typically fall in the center of this gradient and result in intermediate-scale disturbances, removing 30-60% of basal area. Despite their frequency and widespread occurrence, little is known about how intermediate-scale disturbances drive stand development. Here I evaluated the effects of intermediate-scale wind disturbance on the development of Quercus stands in regard to structure and recruitment. My specific objectives were to: 1) quantify damage severity in basal area reduction and percent canopy loss of this particular disturbance along a gradient of wind disturbance, 2) detect structural acceleration or retrogression of stand development caused by an intermediatescale wind disturbance, and 3) elucidate compositional acceleration or retrogression for an intermediate-scale wind disturbance. Basal area was significantly reduced from 25.5 m^2ha^{-1} to 15.5 m^2ha^{-1} (p < 0.001) and PAR was significantly increased within the damaged areas (p < 0.001). Larger trees (> 45 cm DBH) were removed disproportionate to their predisturbance density. In undamaged areas, large trees comprised 4% of total density, whereas 16% of trees killed by the storm were in this size class. Based on our findings, this intermediate-scale disturbance increased intra-stand heterogeneity and accelerated succession, favoring shade-tolerant taxa established in the understory.

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P93 • Rachel L. Craven, Paradise I, Flowers, J. Christopher Havran

Leaf Anatomy of Planchonella sandwicensis on the Islands of Hawai'l

Planchonella sandwicensis is a Hawaiian endemic tree distributed in mesic to dry forests on all main Hawaiian Islands. Previous studies of this highly variable species have suggested an east-west variation in leaf morphology. Our previous research showed that specific leaf area and stomatal density exhibited a significant positive correlation with rainfall. This encouraged us to conduct further studies to see if similar findings would be evident in the internal leaf anatomy. Collections of this plant were made from Kaua'i, O'ahu, Moloka'i, Maui and Hawai'i in 2012. Leaves were fixed and sectioned to 20 µm with a cryostat microtome. Leaf sections were photographed and attributes of the leaf were quantified. We investigated geographical and ecological correlates to features of internal leaf anatomy in the species. Some components of the leaf anatomy were significantly correlated to elevation and rainfall; however, there does not seem to be a clear pattern with these correlations. Some islands possessed some unique leaf attributes. Many of the leaves exhibited multiple lower and upper epidermis layers. This may be evident of the tree's desiccation avoidance mechanism. Specimens from O'ahu possessed smaller ranges of variation in multiple epidermis thickness than other islands. There did not appear to be a geographic pattern in leaf anatomy variation.

Dept of Biological Sciences, Campbell University, Buies Creek, NC

P94 • Haley Hegedus¹, Joshua W. Campbell¹, James Martin²

Pollinator and Beneficial Insect Abundance and Diversity in Four Different Biofuel Treatments

Despite the current prevalence of corn as a biofuel crop, pollinating insects rarely utilize corn fields. However, several types of grasses show potential as surrogates to corn and may also encourage greater diversity of pollinators. To investigate the effects on pollinator abundance and diversity, four different treatments of potential biofuel crops were examined. Treatments included: (1) monoculture of switchgrass (Panicum virgatum) with single harvest, (2) monoculture of switchgrass with multiple harvest, (3) native warm season grass and forb mixture with single harvest (4) native warm season grass and forb mixture with multiple harvest. Insects were collected twice a month for 3 days at a time from each of the different plots using colored bowl traps. Overall, 37,050 potential pollinators and other beneficial insects were captured. Dolochopodidae was the most common beneficial Family captured (70% of total captures). Nineteen different genera of bees were captured within our treatments. Lasioglossum was the most common genera of bees captured (21% of total captures). Overall, neither the native grass/forb mixtures nor the switchgrass treatments exhibited significant differences in pollinator abundances. We suspect the lack of significant differences among treatments is due to bees using native grass/forb mixtures as foraging habitat while switchgrass treatments may have been used as suitable nesting structure.

P95 • Lucas D. Hetherington, Haley E. Clevenger, Wade B. Worthen

Small-Scale Habitat Preferences of Ground Beetles (Coleoptera: Carabidae) and Responses to Vegetative Regrowth After Kudzu Removal

Ground beetles (Coleoptera: Carabidae) are an important component of terrestrial communities; they have been useful as indicator species and they respond quickly to disturbance. We collected ground beetles by pitfall trap in a 0.5 ha field and neighboring ecotone and woodland areas to compare small-scale differences in community structure. On 21 May 2013, the field was cleared of vegetation by bush-hog and Kudzu was spotsprayed with Clopyralid. Two transects were established in field, ecotone, and woodland

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areas, with 8 trapping stations along each transect. Each station consisted of 2 1L cups connected by 1m of aluminum flashing. We sampled three days/week through the summer, conducting a mark-recapture study of large beetles (*Carabus*, *Dicaelus*, and *Pasimachus* species), collecting other species, and measuring vegetative cover in the field. Over the entire experiment, mean carabid abundance was greatest in woodland transects, largely driven by the high woodland abundance of *Cyclotrachelus sigillatus*. Although there were some significant differences is species richness and Simpson's diversity among transects, there were no significant differences in these parameters across habitat types. Community composition did vary, however, with ecotone and woods dominated by *Carabus* and *Dicaelus* species and the field dominated by *Pasimachus* species. *Pasimachus* shifted from the ecotone in the early summer to the field in late summer, correlating with increasing vegetative cover in the field. Carabid communities vary with habitat on a small scale, and respond quickly to changes in the habitat.

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P96 • Eric A. Walker, Victor R. Townsend, Jr.

Interspecific Variation in Ovipositor Morphology Among Cosmetid Harvestmen (Arachnida, Laniatores, Gonyleptoidea)

Prior taxonomic studies of laniatorean harvestmen have largely ignored the external morphology of the ovipositor as a potential source for informative characters. As a result, relatively little is known about interspecific variation in female reproductive anatomy. In this study, we dissected 50 ovipositors from individuals representing 14 cosmetid species. We used scanning electron microscopy to examine the microanatomy of the distal surface, the number, texture and shape of the large peripheral macrosetae, and the general appearance of the vagina. Ovipositors were dehydrated in a graded ethanol series, dried with hexamethyldisilizane, mounted on aluminum stubs, sputter coated with 30 nm of gold, and examined with a Hitachi S-3400 SEM at an accelerating voltage of 10 kV. We observed considerable interspecific variation in the ovipositor, especially with respect to the morphology of the distal tips of the peripheral macrosetae. The functional significance, if any, of interspecific variation in setal structure is unclear. We also observed interspecific variation in vaginal shape, with most, but not all species (i.e., Erginulus clavotibialis and E. subserialis) exhibiting the typical x-shaped vagina. Additional behavioral studies of oviposition behavior are needed to determine if there is a functional relationship between reproductive morphology and oviposition behavior.

Dept of Biology, Virginia Wesleyan College, Norfolk, VA

P97 • H. Joseph Horacek, Wade B. Worthen

The Distribution of Dragonfly Larvae in a South Carolina Stream: Relationships With Sediment Type, Body Size, and the Presence of Other Larvae

We sampled dragonfly larvae by kick seine in Little Creek, Greenville, SC, during summer 2013, to describe the effects of abiotic (sediment type, water depth, distance from bank) and biotic factors (other dragonfly larvae) on larval distribution. Transects crossed the creek at ~ 5m intervals, and three or four 1m x 0.5 m plots were sampled on each transect. In each plot, sediment was characterized as sand, sand-cobble mix, cobble, coarse, or rocky, and water depth and distance from bank were measured. Larvae were identified to species, and body length, head width, and metafemur length were measured. Five common species preferred different sediment types; Progomphus obscurus preferred sandy plots, and Cordulegaster maculata preferred plots with a sand-cobble mix; Ophiogomphus mainensis avoided sandy and rocky plots while Boyeria vinosa and Stylurus albistylus preferred coarse sediments. As a consequence of using the same habitats, P. obscurus and C. maculata co-occurred more frequently than expected by chance, as did O. mainensis, B. vinosa, and S. albistylus. Although mean size varied among species, the mean size of larvae in different sediment types did not differ significantly. However, larval size was important to larval distributions. Larval size was significantly negatively correlated with distance from the bank in P. obscurus and C.

maculata. In addition, larvae in small size classes (< 9mm, 9-12mm) occurred less frequently with large larvae (> 12mm) than expected by chance. This is not a function of relationships with sediment type, and may be a function of competitive displacement or intraguild predation.

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P98 • Monica Henry¹, Laci Gunthorpe¹, Kadie Britt¹, Zachary Slifer¹, Erika A. Scocco¹. Wayne A. Gardner²

A Preliminary Analysis of Quantifying Endemic *Beauveria bassiana* (Balsamo) Vuillemin in Kudzu Patch Soils Where *Megacopta cribraria* Populations Reside

Beauveria bassiana (Balsamo) Vuillemin is an entomopathogen endemic to soils in the United States that cause natural epizootics in insect populations. The GHA strain of this fungus has been commercially formulated to control insect pest populations. One such insect pest that this fungus could potentially control is the kudzu bug, Megacopta cribraria (Fabricius). M. cribraria is an invasive insect of kudzu and agronomic crops with no known natural enemies. However, one report indicated that a kudzu bug was naturally infected with B. bassiana in Georgia. This suggests a natural epizootic could be occurring in kudzu patches in North Carolina. Thus, this study aims to quantify B. bassiana in soil samples of M. cribraria infested kudzu.

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P99 • Brittany D. Harry¹, Flor Acevedo², Michelle Peiffer², Shan Jin², Ketia Shumaker, Dr.¹, Dawn S. Luthe, Dr.², Gary Felton, Dr.²

Corn Earworm Saliva Induces Herbivore Defense Gene Expression in Corn

Corn is one of the most important crops worldwide. Corn earworm (Helicoverpa zea) herbivory on corn is costly in terms of the lack of crop yield that occurs and the damage it does. Caterpillar saliva is known to elicit plant defense response in several plants, but surprisingly the effect of H. zea saliva on corn defenses has not been reported. A series of experiments were conducted to determine the expression of several defense-related genes in Z. mays corn plant hybrid MC 4050 after herbivory by H. zea. We tested the saliva of the H. zea to determine if this factor is an elicitor of Z. mays defense gene expression in corn. Corn plants in the V3 stage were challenged with ablated (cauterized spinnerets) and non-ablated (intact spinnerets) H. zea caterpillars for 24 hours. Control plants were not exposed to H. zea caterpillars. The expression of plant defense genes (MPI, LOX3, RIP2) were analyzed by quantitative real-time PCR (qRT-PCR), using Actin as the endogenous control. We found significant differences (α=0.05) among treatments. The greatest gene expression was observed with non-ablated (intact) caterpillars. These results suggest that H. zea saliva is triggering defenses in corn. This information is important because corn is an important food crop worldwide and understanding the components of H. zea saliva that triggers corn defenses against this herbivore will help scientists develop novel insect control strategies. Future experiments will be aimed at identifying the components of *H. zea* saliva that induces defense gene expression in corn.

P100 • Deep Sangani, Bradley Vaughn, Dr. John Moeller, Dr. Caleb Arrington

Hydrocarbons Involved in Chemosensory Systems of the Parasitoid Wasp, Dasymutilla occidentalis

Dasymutilla occidentalis, a velvet ant, lays its eggs in the brood chambers in bumblebee hives. Once the *D. occidentalis* larvae hatch they feed on the larvae of these hosts, thus establishing its parasitoid nature. During excavation of their nest, the bumblebees likely impregnate the soil with the hydrocarbons from the hairs and outer layer of the cuticle. It is theorized that *D. occidentalis* use chemosensation of these cuticular hydrocarbons in the soil to discover the location of the hives. A behavioral assay suggested that *D. occidentalis* prefer dried, crushed cuticle from bumblebee hosts compared to honey bees,

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a non-host hymenopteran. The purpose of this experiment is to determine the cuticle hydrocarbon involved in the chemosensory preference of *D. occidentalis*. The composition of the bumblebee cuticle was determined by extracting the hydrocarbons with hexane. This hydrocarbon-hexane solution was separated into its individual components by gas chromatograph/mass spectrometry. Comparison of the chromatogram retention times to the retention times of known hydrocarbons allowed for compound identification. From this analysis it was determined that the cuticular hydrocarbons of the bumblebee are composed primarily of long unsaturated hydrocarbons with a few alkene derivatives. A comparison to the cuticular hydrocarbon of the honey bees identified four potential hydrocarbons present in the bumblebee cuticle that are not present in the non-host honey bee. These compounds (7-tricosene, 9-tricosene, 7-pentacosene, and 9-pentacosene) are the best candidates for the chemosensory signal used to locate host nests.

Biological and Chemical Sciences, Wofford College, SC

P101 • Lexie K. Puterbaugh, Jennifer A. Hancock

The Relationship Between Achilles Tendon Dimensions and Ankle Joint Range of Motion in Humans

The purpose of this study was to determine the relationship between Achilles tendon dimensions and ankle range of motion. Ankle range of motion (ROM) was measured in forty participants that were 18 to 25 years of age and did not have any known Achilles tendon pathologies or current lower limb injuries. First, the participants warmed up by performing a 30 second hamstring, quadriceps, and calf stretch for each leg. Then, they sat on a ledge so that their feet did not touch the ground. The base and head of the fifth metatarsal, fibular head, and apex of the lateral malleolus were palpated and marked on each leg. A goniometer was used to measure the angles of dorsiflexion and plantarflexion of each ankle. Each measurement was performed three times, and then the mean dorsiflexion and plantarflexion angles were calculated. The mean ROM was calculated by subtracting the mean dorsiflexion angle from the mean plantarflexion angle. Additionally, the length, width, thickness, and moment arm of the Achilles tendon were measured using ultrasonography. Relative measurements were calculated for each tendon dimension. Length and moment arm measurements were divided by hip height, and width and thickness measurements were divided by weight. Finally, the mean dorsiflexion, plantarflexion, and ROM angles will be regressed against the relative tendon dimensions. It is expected that there will be a relationship between the relative dimensions of the Achilles tendon and the movement of the ankle joint.

Dept of Biology and Environmental Science, Marietta College, Marietta, OH

P102 • Andrew J. Fitzgerald, Jennifer A. Hancock

A Comparison of the Width of the Achilles Tendon in Athletes and Non-Athletes

The purpose of this study was to determine if the width of the Achilles tendon differs among different types of athletes and non-athletes. The forty participants in this study were 18 to 25 years old and did not have any known Achilles tendon pathologies or current lower limb injuries. Each participant filled out a survey that consisted of demographic questions and questions about their performance in athletics and other physical activities. This information was used to categorize participants into different athletic and non-athletic groups: sprinters, jumpers, agility athletes, endurance athletes, non-athletes that are active, and non-active subjects. Additionally, the width of the Achilles tendon was measured using ultrasonography at three locations in each leg: the insertion on the calcaneus, and the musculotendinous junctions of the tendon with the gastrocnemius and soleus muscles. The mean widths of the two legs within an individual were calculated for each measurement location and then divided by the weight of the participant. A repeated measures analysis of variance with one among-subject factor (athletic/non-althetic type) and one within-subjects factor (width measurement location) will be performed to determine if there is a difference in mean relative tendon widths among and within subjects. Additionally, confidence intervals for each grouping and measurement will be calculated. It is expected that sprinters, jumpers, and agility athletes will have a wider tendons than endurance, non-athletic but active, and non-active subjects.

Dept of Biology and Environmental Science, Marietta College, Marietta, OH

P103 • Vanessa Y. Rubio, Cynthia C. Bennington

Genetic Variability and Gender Specialization in Passiflora incarnata

Plants possess a diversity of breeding systems that have evolved in response to selection favoring outcrossing or optimal resource allocation during growth and development. Andromonoecy is a breeding system where individual plants produce both staminate and hermaphroditic (bisexual) flowers. In the andromonoecious vine, *Passiflora incarnata*, prior studies have examined fitness traits of hermaphroditic and staminate flowers. In our study, we compared male fitness traits (e.g., nectar quantity, nectar quality, and pollen tube growth) between hermaphroditic and staminate flowers, accounting for potential differences between genotypes. We conducted these experiments using 30 potted plants of *P. incarnata*, representing six clonally-replicated genotypes originally obtained from natural populations. There was significant genetic variability in traits such as nectar sucrose concentration and pollen diameter, but little evidence that staminate and hermaphroditic flowers differed in male fitness. Ultimately, male fitness is best measured as the number of seeds successfully sired, a variable that is difficult to quantify.

Dept of Biology, Stetson University, DeLand, FL

P104 • John R. Massey¹, Miranda Camp¹, Allyson M. Fenwick¹, Andrew L. Sheldon², Alicia S. Schultheis¹

Genetic Structure and Phylogeography of Great Basin Populations of the Stonefly Hesperoperla pacifica Using Novel Nuclear Loci

Genetic diversity is an important component of biodiversity. Thus, understanding the geographic patterns of genetic diversity and the historical and contemporary processes which led to those patterns can help create a better understanding of biodiversity. The Great Basin's sky island topography has resulted in genetic isolation of montane populations of plants and animals, including the aquatic insect Doroneuaria baumanni. In this study, our goal was to determine whether this pattern holds for other perlid stoneflies, namely Hesperoperla pacifica. We hypothesized that H. pacifica populations would be less structured than those of D. baumanni because H. pacifica has less stringent habitat requirements. We tested our hypothesis in several Great Basin populations using three nuclear loci that were obtained from transcriptome data. FST estimates from these nuclear loci suggest H. pacifica populations are less structured than the previously studied stonefly Doroneuria baumanni, which had three geographically non-overlapping clades. H. pacifica populations commonly share haplotypes and have lower F_{ST} values. Thus, the degree of isolation of stonefly populations may be dependent upon species-specific life history characteristics. Our results underscore the benefits of a comparative approach to understanding the phylogeography of the Great Basin. The contrasting patterns of genetic structure in these two stoneflies highlight the need for studying multiple species to identify potential hotspots of genetic diversity.

Dept of Biology, Stetson University, DeLand, FL; Professor Emeritus, University of Montana

P105 • Fengjie Sun¹, Gustavo Caetano-Anollés²

Phylogenetic Studies Reveal the Evolutionary History of the Structure of 5S Ribosomal RNA

As an integral component of the large subunit of ribosome, 5S rRNA carries out fundamentally important functions during protein synthesis. Due to its associations with the large rRNA subunit and several ribosomal proteins, 5S rRNA has been used as a model molecule for studies on RNA structure, RNA-RNA, and RNA-protein interactions. Structurally, 5S rRNAs are folded into a conserved secondary structure. Despite being a model for the study of RNA structure and RNA-protein interactions, the evolutionary

history of the universally conserved 5S rRNA molecule remains unclear. Here, we apply an award-winning phylogenetic method to reconstruct the evolutionary histories of molecules and substructures of 5S rRNA directly from its molecular structure, and to identify the ancestral functional and structural components that were crucial during its early life. Trees of molecules revealed the tripartite nature of life; superkingdom Archaea formed a paraphyletic basal group, while Bacteria and Eukarya were monophyletic and derived. Trees of molecular substructures support an origin of the molecule in a segment that is homologous to helix I, its initial enhancement with helix III, and the early formation of the three-domain structure typical of modern 5S rRNA in Archaea, while the delayed formation of the 3-branched structure in Bacteria and Eukarya supports the archaeal rooting of the tree of life. The evolution of molecular interactions between 5S rRNA and ribosomal proteins suggested that 5S rRNA represents an evolutionarily late addition to the ribosomal ensemble that occurred prior to the early diversification of Archaea.

¹ School of Science and Technology, Georgia Gwinnett College, Lawrenceville, GA; ² Dept of Crop Science, University of Illinois at Urbana-Champaign, Urbana, IL

P106 • Alex Hart, Gerald L. Smith

Phylogenetic Investigation of Selected *Habranthus* Species, Native Southeastern U.S. *Zephyranthes* Species and Selected Mexican *Zephyranthes* Species

The relationship between rain-lilies classified in *Habranthus* and *Zephyranthes* has been problematic. We conducted an ISSR fingerprinting study to gain Insights into the generic relationships among the rain-lilies. The gels were scored and the data used to build a matrix which was analyzed in PAUP* 4.0b2. The tree that was generated from the matrix in MacClade 4.0 revealed that *Habranthus* taxa form a monophyletic clade. Additionally, the *Habranthus* clade was sister to a clade comprising the native southeastern species of *Zephyranthes* and to a clade comprising selected Mexican taxa. At this time we are not recognizing these Mexican taxa as a genus distinct from *Zephyranthes* but recommend additional investigations to clarify the taxonomic level of relatedness. The three clades that we produced have also been noted in an independent ISSR study by A. Spurrier and in DNA sequencing studies by A. Meerow.

Biology Dept, High Point University, High Point, NC

P107 • Holly Bell, Sarah Marie Noble

A Bryofloristic Investigation of the Limestone Hills Region of South Alabama and Mississippi

Bryophytes collected from the Limestone Hills region of south Alabama and south Mississippi were surveyed. Locations along the Alabama and Mississippi East Gulf Coastal Plain were sampled for bryophytes over the course of forty-eight months. The most intensively sampled environmental gradient was shaded, damp, limestone. Geographical affinities were noted.

Dept of Natural Sciences, University of Mobile, Mobile, AL

P108 • Bailee Dykes, Alvin Diamond, Michael Woods

The Vascular Flora of Bullock County, Alabama

The vascular flora of Bullock County, Alabama, was surveyed from 2011 to 2013. Bullock County is located in the southeastern portion of the state, and has an area of 162,278 hectares. The major natural areas of the county are the Alabama-Mississippi Blackland Prairie and the Chunnenuggee Hills divisions of the East Gulf Coastal Plain. To increase the diversity of taxa collected, an attempt was made to sample all habitats within the county. Prior to this study, only 525 taxa representing 301 genera and 107 families were documented from the county. A total of 1155 taxa representing 547 genera and 161 families were collected or reported from Bullock County. Sixty-six species represented by herbarium specimens from Bullock County were not re-collected during this study. The Inventory List of Rare, Threatened and Endangered Plants, Animals and Natural Communities of Alabama as compiled by the Alabama Natural Heritage Program contains 19 of the species collected. Approximately 21 percent of the flora (237 species), are

considered non-indigenous. Families with the largest number of taxa were Asteraceae (159), Poaceae (147), Fabaceae (83), Cyperaceae (78), Rosaceae (38), and Lamiaceae (35).

Dept of Biological and Environmental Sciences, Troy University, Troy, AL

P109 • Alexander D. DeGenova, Andrew G. Gardner, Rachel S. Jabaily

Dispersal Modes and Areas of Origin of Invasive Species in an Old Growth Urban Forest

Overton Park is a 342-acre hardwood forest located within an urban-residential area of Memphis, Tennessee. Forests found in close proximity to urban areas are often strongly impacted by ecological disturbances, including invasive species introduction. An ongoing inventory of vascular plants for the Rhodes College herbarium (SWMT) found eighty-three plant species to be non-native, including eight known invasive species present in the park. The abundance of animal vectors (e.g. dogs, birds, and humans) increases the likelihood of plant dispersal throughout the park, resulting in the introduction and spread of nonnative and potentially invasive species. Consequently, I hypothesized that the majority of invasive plant species in Overton have fruits and seeds that are dispersed by animals. Additionally, the popularity of ornamental Asian species for horticulture in the southeastern United States led me to hypothesize that the majority of invasive plant species in the park are Asian in origin. Ninety-one species were collected and categorized by geographic area of origin and fruit dispersal mode. I found that 60 percent of collected species were native, 40 percent were non-native, and nine percent of all species were invasive. Sixty-four percent of invasive species had seeds dispersed by animals, and 64 percent of the invasives were native to Asia, supporting the hypotheses. The collection and documentation of invasive species found in parks like Overton is important, because conservation strategies are often specifically tailored to deal with the invasive plants present in the target area.

Dept of Biology, Rhodes College, Memphis, TN

P110 • Wendy B. Zomlefer¹, Linda G. Chafin², J. Richard Carter³, David E. Giannasi¹, Cristin Walters¹

Coefficient of Conservatism Rankings for the Flora of Georgia: Wetland Indicator Species

Wetland habitats currently cover about one-fifth of Georgia and have been reduced in acreage by as much as twenty-five percent over the past two centuries due to anthropogenic activities. Accurate identification and careful study of these areas are crucial for their preservation and for compliance with federal and state environmental regulations. Several vegetation-based biological assessment methodologies have been developed to define wetlands and to assess their quality. One major wetland delineation system, mandated by federal law, incorporates the National Wetland Plant List (NWPL), a classification system ranking plant species in five indicator categories according to fidelity and preference for wetlands or uplands. These rankings were recently updated via a comprehensive and collaborative nationwide effort involving four government agencies and teams of wetland specialists. Another expert-based indicator system, Coefficients of Conservatism, is the foundation of the Floristic Quality Index, a metric widely used in the United States for assessing ecological condition of wetlands (as well as other plant communities). The Coefficients are based on breadth of habitat preference(s) and tolerance to disturbance, with exotic and ruderal species receiving the lowest scores, and ecologically conservative species, the highest scores. A team of four botanists, proficient with the flora of Georgia, convened to assign Coefficient of Conservatism rankings to the 2,262 NWPL species for the state. The resulting Web-accessible database, which includes information such as regional wetland rankings and conservation status, is described here.

Dept of Plant Biology, University of Georgia, Athens, GA; State Botanical Garden of Georgia, University of Georgia, Athens, GA; Dept of Biology, Valdosta State University, Valdosta, GA

P111 • Laary Cushman¹, Patrick McMillan¹, Kathy Mathews²

Incipient Speciation in Hydatica Necker

In 2002 a unique population of Hydatica Neck, was discovered in the upper Piedmont of Pickens County, SC growing on a low-elevation granite dome. The plants appeared to be very similar to the widespread Hydatica petiolaris but display an annual life form and flower during the late winter and early spring. A study was initiated to determine if the population in Pickens County meets the criteria of the biological, phylogenetic and ecological species concepts and thus constitutes a novel species. We utilized dried plant collections and measurements taken from living specimens to assess the morphological distinctions. Internal Transcribed Spacer (ITS) sequence analysis of tissue samples from both high-elevation H. petiolaris and plants from the low-elevation populations was performed to assess phylogenetic species criteria and the ecological conditions on each of the sites is being monitored and recorded using Hobo Monitors to determine variations between the populations. Controlled garden experiments are being conducted to determine if the flowering time and life form is merely a response that is possible among the widespread high-elevation populations. Floral morphology, stature and life-form prove distinct. Due to range and flowering time these populations are biologically segregated and thus meet the biological species criteria. Previous ITS sequencing of the Pickens Co. study plot showed a distinct and separate lineage when compared to high elevation plots. Low elevation isolation has led to morphological, biological, and phenotypic variation in this population that could represent a novel or incipient species.

¹ Dept. of Plant and Environmental Sciences, Clemson University, Clemson, SC; ² Dept. of Biology, Western Carolina University, Cullowhee, NC

P112 • Penny A. Carroll Ashley B. Morris

Phylogeographic Analysis of the American Beech (Fagus grandifolia)

The purpose of this research is to take a multi-faceted approach to testing biogeographic hypotheses in the American beech (*Fagus grandifolia*; Fagaceae). Previous work using chloroplast sequence data was unable to provide sufficient resolution to address questions of intraspecific taxonomy and evolutionary history. Our approach will involve sampling hundreds of individuals from multiple populations distributed from Nova Scotia to Mexico. Samples will be genotyped using nuclear and chloroplast microsatellite loci, and also with chloroplast DNA sequences. Fossil calibration of phylogenetic hypotheses will be used to estimate intraspecific divergence times. Species distribution models will be used to hindcast paleodistributions and to forecast future distributions under scenarios of climate change. The American beech faces many pressures, including forest degradation, land development, and the spread of beech bark disease. By using an interdisciplinary approach, we hope to clarify a number of ecological and evolutionary questions that have practical applications for forest management strategies.

Dept of Biology and Program of Molecular Biosciences, Middle Tennessee State University, Murfreesboro, TN 37132

P113 • Jessica M. Bartek, Amy M. Vardeman, Richard Carter

Digitization of the Valdosta State University Herbarium: Undergraduate Student Perspectives

The Valdosta State University [VSU] Herbarium is an actively growing collection of more than 65,000 vascular plant and bryophyte specimens. An NSF-funded project to digitize the VSU Herbarium is currently nearing completion. Digitization and associated collections improvement tasks at the VSU Herbarium have been accomplished largely through the efforts of undergraduate student assistants. Basic aspects of workflow and output for specimen mounting, data entry, imaging, and related activities will be presented from the perspective of the student assistants. An important broader impact of this digitization project is to instill knowledge and encourage appreciation of the importance of plants to society and the value of biological research collections, as well as to teach basic soft skills

that will benefit students beyond their baccalaureate experience. The student assistants will describe how their hands-on involvement with this project will enhance their careers and their lives.

Biology Dept, Valdosta State University, Valdosta, GA

P114 • Thomas G. Ludwig, Melanie A. Link-Perez

Distinguishing Adiantopsis alata From A. radiata Through Isolation and Amplification of Genomic DNA

Adiantopsis Fée is a small genus (30-40 species) of ferns in the cheilanthoid clade of the Pteridaceae. One species in this genus is known as Adiantopsis alata. It was described in the late 1880's by Karl Anton Eugen Prantl but has generally been subsumed into A. radiata since many workers regarded the two species as identical. Adiantopsis radiata is the most widespread species in the genus and has many morphological similarities to A. alata. An in-depth morphological study conducted by the Link-Pérez lab suggests that A. alata is actually a distinct species. The objective of this project was to collect molecular data to clarify the taxonomic identity and phylogentic placement of A. alata. Total genomic DNA was isolated from six samples of A. alata and the plastid genes rbcL and atpA were amplified. The DNA sequences were compared to those of the rest of the clade to determine A. alata's relationship to A. radiata and the other species within the genus. Phylogenetic analysis has confirmed that A. alata is molecularly distinct from A. radiata. Furthermore, A. alata is less closely related to A. radiata than some other members of the genus.

Dept of Biology, Armstrong Atlantic State University, Savannah, GA

P115 • Timothy J. Cole, Elizabeth G. Dobbins

Effects of Surface Runoff From a Landfill Containing Coal Ash on Water Chemistry in Adjacent Surface Water in Perry County, Alabama

Coal ash is a combustion residue that is a major byproduct of coal-powered electricity generation. Coal ash often contains contaminants including arsenic, boron, chromium, and sulfide. In 2008, Perry County's Arrowhead landfill became the recipient of 2.3 million m^3 of coal ash removed from the Emory and Clinch Rivers after a rupture of TVA Kingston Fossil Plant's coal ash containment site. This landfill is adjacent to several residences and the upstream of small tributaries that run through fields of cattle and into local creeks. We surveyed surface water around the landfill in the summer of 2013 and January 2014 to determine if the water quality was affected by the landfill. The conductivity, total dissolved solids, and arsenic concentration of the water directly running off and adjacent to the landfill were significantly higher than a control stream that does not interact with the landfill (P < 0.01). Arsenic levels were higher than EPA drinking water, but not surface water, guidelines. Concentrations of other indicators of coal ash such as boron, chromium, and sulfide were not significantly different from the control. This preliminary evidence indicates that the landfill has an effect on the water quality in tributaries of Chilatchee Creek.

Dept of Biological and Environmental Sciences, Samford University, Birmingham, AL.

P116 • Donna Saylor, William Ensign

Growth Rate of Tipulidae on Ligustrum sinense And Liriodendron tulipifera

Ligustrum sinense (Chinese Privet) becomes more common in stream riparian zones as urbanization increases. As native deciduous species are replaced and privet takes over, the proportion of privet in the leaf litter increases, changing the food source of invertebrate shredders in the stream. The main purpose of this study was to determine if invertebrates in the family Tipulidae, a main shredder of leaf litter, will utilize L. sinense as a food source. We hypothesize that tipulids will prefer a diet of native Liriodendron tulipifera (Tulip Poplar) over a diet of L. sinense. To test this hypothesis, we compared the relative growth rates of tipulids on diets of L. sinense and L. tulipifera. Our prediction was that the growth rate of tipulids on L. sinense would be less than the growth rate of tipulids on L. tulipifera. Tipulids were maintained in laboratory mesocosms for six weeks and fed an ad

libitum diet of either preconditioned *L. sinense* or *L. tulipifera* leaves. Leaves were preconditioned by placing leaf packs into a stream to allow colonization by microbes and fungi. Weights were obtained weekly and any mortalities recorded. There were no significant differences in growth rates between the treatments, but overall mortality was higher on the *L. sinense* diet.

Dept of Biology and Physics, Kennesaw State University, Kennesaw, GA

P117 • Michael Schooling, William Ensign

Urbanization and Gut Length in Campostoma oligolepis

Urbanization can dramatically alter watersheds resulting in shifts in autochthonous and allocthonous contributions to trophic pathways. Differences in food quality and algal or periphyton nutritional content have been linked to differences in the gut lengths of herbivorous freshwater fishes. The purpose of this study was to determine if there is a relationship between stream urbanization levels and gut length in Campostoma oligolepis, an herbivorous minnow. Campostoma oligolepis were obtained from 12 sites in tributaries to the Etowah River in northwest Georgia. Urbanization levels for the sites ranged from heavily impacted by urban development to fully forested. Watershed area also varied at the twelve sites, ranging from 3.6 km² to 133.1 km². Twenty individuals were obtained from each site, preserved and returned to the lab where the entire gastrointestinal tract was removed and measured. Standard length of each individual was also measured and a gut length/fish length ratio (Qg) established. There were significant differences in Q a among sites (ANOVA p < 0.05) with fish from sites with higher levels of urbanization exhibiting lower Q₀ ratios. Also, in watersheds with high levels of urbanization Q₀ increased with decreasing stream size while the pattern was reversed in watersheds with lower urbanization levels. These patterns are consistent with the expected increase in quantity and quality of periphyton that should be found in urbanized watersheds.

Dept of Biology and Physics, Kennesaw State University, Kennesaw, GA

P118 • Rachel Schomaker, Molly Klinepeter, Celina Bellanceau, Gabriel Herrick

Habitat Distribution and Ecology of Dragonfly and Damselfly Naiads

Predation plays a key role in sustaining the overall community structure of an ecosystem. Dragonfly and damselfly naiads (order Odonata) are predators in aquatic habitats; they contribute to the control of prey populations, which has the potential to affect both the aquatic and the surrounding terrestrial ecosystems. We investigate the relationship between Odonata naiad abundance and habitat structure. Odonata naiads were collected from four habitat types in a lake in Florida to investigate the distribution and abundance of the naiads in each different habitat. We hypothesized that the naiads would be distributed in higher abundances for habitats with vegetation present. Further, we expected differences in Odonata naiad abundances between habitats to correlate with differences in the community structures. We found that habitat type does have a significant affect (p<0.01) on the abundance of Odonata naiads. Furthermore, naiad abundance differed among sites with different types of vegetation, indicating that vegetation type is important to naiad distribution. An avenue for future research includes investigating the effects of naiad abundance on community structure.

Biology Dept, Florida Southern College, Lakeland, Fl

P119 • Cyrus H. Bahram, Justin C. Strickland, Leigh Anne Harden, Shannon E. Pittman, Maximilian M. Kern, Michael E. Dorcas

Influence of Sex and Migration Behavior on Reproductive Cost of Spotted Salamanders (Ambystoma maculatum)

Small, isolated wetlands encourage biodiversity by connecting diverse populations of wetland species and providing a habitat for region-specific species. In particular, many semi-aquatic species use ephemeral wetlands for breeding and juvenile development. Understanding the factors that influence amphibian reproduction is critical to informing conservation efforts and wetland regulations. To address this issue, we examined body

mass changes of spotted salamanders (*Ambystoma maculatum*) during their seasonal breeding migrations. We sampled salamanders entering and leaving a 0.5 ha ephemeral wetland in the North Carolina Piedmont using 40 aquatic funnel traps and a 400 m drift fence completely encircling the wetland with 38 pitfall traps at 10 m intervals. Traps were checked daily during two annual breeding migrations January - February 2013 and 2014 and salamanders marked and measured (i.e., sex, mass, snout-vent length, and total length). The relationship between body mass changes and explanatory factors including sex, duration of stay at wetland, aquatic movement frequencies, and minimum movement distance were examined using a set of candidate linear mixed models selected *a priori* and compared using Akaike's Information Criterion (AIC_c). Our results revealed the relationship between body mass changes, sex, and migration behavior in *A. maculatum*, demonstrating the relative importance of these factors in determining reproduction costs. Our findings will help inform aquatic and upland habitat management and policy impact on the reproductive health of semi-aquatic amphibians.

Dept of Biology, Davidson College, Davidson, NC

P120 • Codie Picariello, Elizabeth Tuttle, Matthew N. Waters, Gretchen K. Bielmyer

Epiphytic Algal Community Structure in Response to Watershed Land Use and Environmental Stressors in Four South Georgia Streams

Epiphytic algae, or biofilms, are important components of stream ecosystems, providing a source of organic carbon, oxygen, and other services. These services can be impacted by various environmental and anthropogenic factors such as flow rate, light, and watershed land use. Here, we analyzed epiphytic algal community composition from four streams in South Georgia of different orders and land uses, in order to understand the impacts of these stressors on stream primary producers . The streams sampled were One Mile Branch (1st order, urban land use), Sugar Creek (2nd order, urban and forest land use), Little River (3rd order, forest and agricultural land use), and Withlacoochee River(4th order, forest, agricultural, and urban land use). Epiphytic algae developed on tile traps that were placed into the streams and sampled on a monthly basis. Algal community composition was determined by measuring chlorophylls and carotenoids through high performance liquid chromatography (HPLC). Community structure for all four streams was predominantly diatoms, but green algae were also a significant component. Detrital material increased with gauge height for lower order streams (first-third), but decreased with the highest order stream sampled (Withlacoochee, fourth order). For the majority of pigments measured, total pigment amounts decreased in correlation to gauge height with the exception of the lowest order stream. Our results show that epiphytic community structure responded greater to environmental factors such as precipitation and DOC rather than watershed land use.

Dept of Biology, Valdosta State University, Valdosta, GA

P121 • Elizabeth G. Dobbins, Kristin A. Bakkegard

Efficacy of Rock Vanes at Reducing Local Erosion in an Urban Stream in Jefferson County, AL

One of the challenges of urbanization is the increase in stormwater runoff due to a greater area of impervious surface. In response to increased water volume, streams enlarge by eroding the banks and scouring the streambed. The net result is a greater sediment load in the water column. Rock vanes are used to mitigate these effects by channeling water energy midstream. Little is known about the long-term efficacy of rock vanes in reducing in-stream sediment. We implemented two new methods of investigating sediment deposition: ceramic tiles and sediment scoops. Both methods were used over four years in four regions of Shades Creek, a third order urban stream: 100m upstream of 10 rock vanes (control), the upstream rock vanes, the downstream rock vanes, and 50m downstream of the rock vanes (control). Before installation of the vanes, the highest sediment deposition was in the area of highest local erosion, the reason the rock vanes were needed. After installation, there was significantly less sediment below this site;

however, during times of low rainfall (<2), we detected an increase in local sediment deposition caused by an upstream commercial construction project. The downstream vanes and downstream control had a significant increase in the smallest, most damaging to the biota, sediments (< 250 microns). During high rainfall (>4), local erosion persisted and the downstream vanes had the highest sediment deposition. Although rock vanes may mitigate sediment deposition, they are not a panacea for urban stream syndrome.

Dept of Biological and Environmental Sciences, Samford University, Birmingham, AL.

P122 • Cliff H. Crummey, James T. Ragan, Matthew N. Waters, Gretchen K. Bielmyer

The Impacts of Watershed Land Use and Environmental Factors on Sediment Transport and Light Attenuation in Four Streams in South Georgia

Sediment and organic matter inputs are primary geomorphic processes in streams and can greatly impact ecological functions. While precipitation can influence sediment inputs, land use and seasonality can alter the type of organic matter entering the streams. The focus of this research was to determine how land use and other environmental factors relate to material transport, substrate deposition, and light attenuation in streams. Two of the four streams in our study were surrounded predominately by forest and agriculture land use: the Withlacoochee (4th order) and the Little River (3rd order). The remaining two: One Mile Branch (1st order) and Sugar Creek (2nd order) were largely impacted by urban areas. Sampling was conducted on two week intervals to monitor total suspended solids (TSS), bed substrate, and dissolved organic matter. TSS was sampled through filtration, and bed substrate was identified by sieving. Filtered water samples were analyzed for light blocking properties using a spectrophotometer to determine chromophoric dissolved organic matter. Results indicate that stream substrates were dominated by sand and boulders (>98%) with organic matter accounting for around 0.02% of total bedload. Total suspended solids for lower order streams increased rapidly following a precipitation event, while larger order streams indicated a delayed influx from tributaries. Chromophoric dissolved organic matter was higher in larger streams and a rise in gauge height showed a decrease in CDOM in all four streams. Results show that general patterns of sediment transport and light attenuation relate to both precipitation and land use in South Georgia streams.

Biology Dept, Valdosta State University, Valdosta, GA

P123 • Christian R. Barrett, Timothy Burns, Vladislav Gulis

Extracellular Enzyme Activity of Plant Litter-Associated Microorganisms Depends on Dissolved Inorganic Nutrient Availability

Plant litter-associated microbial decomposers (primarily fungi) are important intermediaries in carbon and energy flow in streams. Since they can obtain nitrogen (N) and phosphorus (P) from both the substrate and the water column, changes in dissolved inorganic nutrient availability (e.g. due to human impacts) may affect the activity of extracellular enzymes involved in N, P and carbon (C) acquisition from organic substrates. We measured the activity of phosphatase, chitinase, leucine aminopeptidase and betaglucosidase associated with decomposing plant litter differing in C quality and N and P content (maple and rhododendron leaf litter, wood veneers) in streamside channels with manipulated concentrations of dissolved inorganic N, P, and N:P ratios. Artificial fluorogenic substrates have been used for all assays. Phosphatase activity per unit of fungal biomass showed a strong negative correlation with dissolved P concentration for all substrates (R²=0.73-0.81, p<0.014) supporting our hypothesis that production of P-mining enzymes is suppressed when inorganic P is available. However, we did not find any significant relationship between the activity of N-acquiring enzymes (chitinase + leucine aminopeptidase) per unit of fungal biomass and inorganic N concentration. Betaglucosidase activity was driven mostly by dissolved N, but not P, availability. Thus, dissolved nutrient concentrations modulate microbially driven plant litter decomposition, nutrient immobilization and transfer to higher trophic levels.

Dept of Biology, Coastal Carolina University, Conway, SC

P124 • Charlie R. Wiggins, Aundrea N. Duncan, Amber N. Blocker, Dr. Gretchen K. Bielmyer, Dr. Matthew N. Waters

The Impact of Urbanization on Water Quality in Four Rivers With Varying Degrees of Anthropogenic Disturbance

A study was conducted to determine the impact of urbanization on four streams of varying orders and surrounded by varying degrees of urbanization. Several water quality parameters were measured at three different sites along each stream over time including: alkalinity, hardness, chloride, pH, carbon dioxide (CO₂), dissolved oxygen (DO), temperature, ammonia, nitrate, and nitrite. So far, we have observed differences in water quality between the sites, as a consequence of rainfall and river depth, and due to changing seasons. For example, hardness and alkalinity differed among sites. Increased rainfall resulted in elevated CO₂ and decreased pH in all four of the streams, particularly in the more shallow areas. Additionally, decreased temperature and nutrient concentrations were correlated with increased DO. Due to urbanization, many factors, such as rainwater, runoff from homes and farms, and increased organic debris, may contribute to increased nutrient concentrations, which can increase phytoplankton growth and decrease oxygen levels; thus impacting community structure. The biological diversity of each sampling site is also being calculated using Shannon-Weiner and Simpson's Index of Diversity and will be correlated to the water quality parameters and surrounding land use at each site.

Biology Dept, Valdosta State University, Valdosta, GA

P125 • Elyse Russing, L. M. Siefferman, M. D. Madritch, Michael Gangloff

Influence of Small Dams on Leaf Decomposition and Invertebrate Communities in Western North Carolina Streams

Stream restoration increasingly targets restoring hydrological connectivity via dam removal but dam impacts on stream ecosystem function remain poorly understood. We used a field experiment to examine impacts of small impoundments on leaf decomposition in 2 western North Carolina streams. We placed sugar maple leaf packs at three sites associated with 1 intact, 1 breached and 1 relict dams. Leaf packs were removed at 4-week intervals between October 2012 and January 2013 and we quantified water chemistry and mass lost. In addition, we quantified invertebrate abundance, species richness and diversity. Preliminary data suggests that leaf decomposition rates are paradoxically higher in impoundments despite the fact that these habitats harbor reduced invertebrate abundance and richness relative to up and downstream, free-flowing reaches. These findings suggest that microbial or physical decomposition may be driving detritus processing in reaches downstream of small dams, possibly as a response to dam-induced physical habitat and water chemistry changes. On-going work will attempt to disentangle the microbial and invertebrate components of this pattern and assess broader-scale effects of impoundments on stream energy pathways.

Dept of Biology, Appalachian State University, Boone, NC

P126 • Catherine, W. Bennett, Karen, K. Bernd

Characterizing the Effects of Electronic Cigarettes: The Development of a Vaping Study

Electronic cigarettes (e-cigarettes) have emerged as an alternative to traditional tobacco cigarettes. With commercial production and increased use of e-cigarettes, regulatory agencies, including the WHO and FDA, are seeking data regarding their safety. Studies have been conducted to determine the chemical composition of e-cigarettes, but studies have not been performed to look at the effects of e-cigarette vapor on alveolar cells. In this study, methods were developed to expose alveolar cells (L2 cells) grown in culture to e-cigarette vapor. L2 cells were exposed to e-cigarette vapor for 2 seconds per minute for 30 minutes, and the neutral red dye (NRD) cytotoxicity assay was performed to determine cell viability. Data underscores the importance of parallel (rather than sequential) exposure and processing of vapor-treated and untreated cells. Preliminary data suggests small differences in viability with e-cigarette vapor leading to no difference in cell number.

Further experimentation is necessary to increase the sample size and apply analysis for statistical significance.

Dept of Biology, Davidson College, Davidson, NC

P127 • Amber Brown

Relative Gene Expression of Mortality Factor 4-Like 2 Rattus norvegicus Schwann Cells Following Activation of Protease Activated Receptor-1

Protease Activated Receptor-1 (PAR-1), a seven transmembrane G-protein coupled receptor localized to the membranes of motor neurons and is activated normally by thrombin or by the synthetic peptide, SFLLRNP. Activation of PAR-1 by either means results in motor neuron apoptosis; however, its role in Schwann cells is just beginning to be understood. Preliminary results from our lab show that PAR-1 activation on Schwann cells leads to apoptosis and an alteration of cell morphology. To examine the molecular changes that may be involved, microarray analysis was performed following PAR-1 activation by 100 nM SFLLRNP. Microarray analysis revealed a significant increase in gene expression of mortality factor 4-like 2 (morf4/2), a gene involved in cell survival, 12 hours after PAR-1 activation. Since microarray analysis often yields false positive results, g-RTPCR was conducted following PAR-1 activation at 0, 4, 8, and 12 hour time points. The results showed that there was no significant difference at any of the time points in the expression of morf4/2 suggesting that the microarray differences for this gene were a false positive and that Schwann cell apoptosis is not dependent on morf412. Despite these results, further research in our lab is focused on verifying other genes that were indicated as potential targets of PAR-1 activation.

Biology, Furman University, Greenville, SC.

P128 • Zachary C. Perdun, Katey M. Robinson, Dr. Diana Ivankovic, Dr. Donna Weinbrenner

Anticarcinogenic Properties of Extracts Derived From the *Clusia rosea* Tree Tested on Rat Derived Pheochromocytoma (PC12), ASPC-1 Pancreatic Cancer Cell Line and AGS Gastric Adenocarcinoma Cell Line

The purpose of this experiment was to assess any potential cytotoxic, antiproliferative or neurodegenerative properties of extracts from the tree *Clusia rosea*. Cell viability and proliferation of two morphologies of rat derived pheochromocytoma (PC12 cells), ASPC-1 pancreatic cancer cell line and AGS gastric adenocarcinoma cell line were all tested in the presence of crude extracts of *Clusia rosea* prepared using the soxhlet apparatus extraction method. The extraction solvents used were methanol, deionized distilled water and methylene chloride for duration of 20-24 hours in the apparatus. The extracts used were derived from the leaves and stems of both young and mature plants. The extracts were added to cell growth medium at varying concentrations, then applied to all cell lines. The PC12 cell line was differentiated with 100ng/mL neural growth factor (NGF) for 48 hours while being sub-cultured on rat tailed collagen coated growth vessels. Proteins distinctly associated with neuronal growth in the differentiated morphology were assessed using a western blot analysis, and an MTS cell viability assay was performed on the tumor morphology of the PC12 cell line, the ASPC-1 cell line and the AGS gastric adenocarcinoma cell line after the extracts were allowed to incubate for 48-96 hours.

Dept of Biology, Anderson University, Anderson, SC

P129 • Rebecca J. Allen, Melissa M. Fox

Protein Expression Analysis of the AMPK Pathway in Human Melanoma: Identifying the Pros and Cons of Metformin Therapy

Metformin, an AMPK activator, is an anti-diabetic agent that has gained attention in the oncology field due to preclinical findings that suggest anti-tumor effects. Importantly, however, some studies have revealed alarming adverse consequences of using this drug for cancer therapy whereby metformin promotes tumor survival through induction of angiogenesis. Here, metastatic MDA-MB-435 human melanoma cells treated with

metformin were evaluated using immunohistochemistry to determine whether the Metformin-AMPK activation process promoted or inhibited the tissue invasion survival phenotype. It was hypothesized that AMPK activation would ablate tumor invasion potential by inhibiting nuclear (active) NFxB and consequently inhibiting MMP-9 secretion. Since NFxB was found to be cytoplasmic and non-active in all samples it was concluded that the Metformin-AMPK activation process had no effect on its activity in this melanoma model. Interestingly, however, MMP-9 did demonstrate protein up-regulation as a result of metformin therapy. Since the protein regulation was not occurring through NFxB signaling, an alternative pathway that bridges the Metformin-AMPK activation process to MMP-9 production must exist. Future studies will focus on identifying this missing link and evaluating whether this link also contributes to the other survival pathways such as angiogenesis. Identification of such a protein could generate a biomarker signature that can be used in the clinic to identify patient candidates that may benefit from metformin therapy and eliminate risk for those who are contraindicated.

Wingate University

P130 • Brianna L. Taylor, Naomi Jackson, Benjamin J. Thornton

The Effects of Ascorbic Acid on *Drosophila melanogaster* Susceptibility to Permethrin and Suppression of Cytochrome P450 Activity

3-Phenoxybenzyl (1RS)-cis,trans-3-(2,2-dichlorovinyl)-2,2dimethylcyclopropanecarboxylate, is a widely used pesticide in the United States as well as other countries around the world. Because of the pervasive use many non-target species are exposed resulting in challenges to individuals and possibly populations. An organism's defense against toxins in general, including permethrin, is via detoxification by ubiquitous enzyme systems, such as cytochrome P450s. Their role in the detoxification process is to oxidize xenobiotics, thereby increasing solubility in water and promoting excretion (Zhu et al. 2008). A number of studies have shown that dietary vitamin supplementation can enhance detoxification (Brodfuehrer & Zannoni 1986; Zannoni et al. 1982). The current study tested the susceptibility of Drosophila melanogaster to permethrin subsequent to exposure to various concentrations of ascorbic acid. Percent survivorship was determined revealing a sex-dependent response. Ascorbic acid supplementation had no observable effect on female susceptibility to permethrin. Males exposed to 15% ascorbic acid exhibited a significant increase in survivorship compared to controls. Lang and Liu (2013) showed that elevated P450 gene expression enhanced resistance to Permethrin in Culex auinquefasciatus. In this investigation, males exposed to 15% and 20% ascorbic acid showed an unexpected significant decrease in cytochrome P450 enzyme activity compared to the control. Females showed a similar change in P450 activity in the 20% exposure only. These documented changes in P450 activity do not explain the observed increased resistance to Permethrin in male D. melanogaster.

Biology and Allied Health, Southern Adventist University, Collegedale, TN

P131 • Lucas Newman, Paul A. Scott, Sarah Rosario, Amanda L. Duffus, Mustapha Durojaiye, Cathy Lee

DNA Barcoding as an Educational Tool: An Ongoing Research Project at Gordon State College

In 2012, a project involving plant DNA barcoding was started at Gordon State College to improve student engagement in upper division and senior level research courses. DNA barcoding involves in collection of specimens of interest for an identification and laboratory analysis of DNA barcode sequences. The data are then placed in a database for subsequent analyses. One of the most important components of the Barcode Initiative is the construction of a public reference library of species identifiers which could be used to assign unknown specimens to known species. This provides an excellent molecular tool for students to be trained to collect, manage, and analyze DNA barcode data. In Fall 2012 and Spring 2013 by the Biotechnology and special research topics classes, three groups of six students isolated genomic DNA from 30 vegetable and 30 fruit species from local

grocery stores and the nine plant species from the Gordon State College Walking Trail. Genomic DNA preparation was done using PureLinkTM Plant DNA Total DNA Purification Kits (Invitrogen, Carlsbad, CA). The students amplified chloroplast rbcL sequences by polymerase chain reaction (PCR) using those isolated the genomic DNA templates and DNA sequencing was done by GeneWiz. The students currently enrolled in the special research topics course in Fall 2013 are analyzing DNA sequences using MEGA software to understand the evolutionary relationship of these species and further analysis DNA barcoding data. This provides an excellent educational research project within the undergraduate upper division biology lab classes and the special research topics course.

Biology Dept, School of Arts and Sciences, Gordon State College, Barnesville, GA

P132 • Donna A. Goodenow, Patricia A. Koplas, Jeffrey Thomas

Why Did You Die? A Post-Mortem Analysis of Avian Tissues

Animals may be brought into rehabilitation centers because of physical trauma, toxic exposure or disease. When dead animals are recovered, the cause of death is not always apparent. Tissue samples can be used in association with veterinary necropsies to assess potential causes of mortality. The main objective of this project is to optimize the staining procedures for raptor tissue in order for an avian pathologist to be able to determine any potential pathology in the tissues. Staining protocols for the Hemotoxylin and Eosin, the Hopps Brown gram staining, and the Giemsa stain have been modified to suit various raptor tissues Including but not limited to gut, pancreas, kidney, liver, heart and stomach. All raptor tissue was provided by the Carolina Raptor Center and the tissues were embedded in paraffin, sliced and set by a local histologist with the Cannon Research Center. These modified staining protocols have been successful and the quality of the stains confirmed by experts in the field. With histological analysis of these raptor tissues it is possible to diagnose problems in the raptor population. The data from this analysis, combined with the medical data from the Carolina Raptor Center, can provide detailed information about both the natural and anthropogenic causes of disease and injury in natural populations of birds of prey.

Biology Dept, Queens University, Charlotte, NC

P133 • Zara Latif, Dora Geving, Nick Ragsdale

Longterm Chemotaxic Ability of Caenorhabditis elegans Following Treatment With 6-Hydroxydopamine

Parkinson's disease, a neurodegenerative disorder, is caused by the degeneration of dopaminergic neurons in the substantia nigra. The neuronal death could be due to oxygen free-radicals. Superoxide dismutase is responsible for converting the oxygen free-radicals into less toxic by-products. Characteristics of the disease include disturbed movement, bradykinesia in arms and legs, and resting tremors. It is believed that the neurotoxin 6hydroxydopamine (6-OHDA) is the cause of this degeneration. Caenorhabditis elegans (C. elegans) are an ideal organism to study this effect because the species has a simple nervous system. Evaluating how this neurotoxin works on the C.elegans gathers information that relates to the human condition of Parkinson's disease, and this may provide progress towards a cure. Past research has shown that treating the nematode with 6-OHDA causes a negative effect in the organism's ability to chemotax. The chemotaxis assay provides information on the organism's speed and movement. In this experiment, the C. elegans were treated with 6-OHDA and tested for three successive days. An ANOVA test compared the worms' abilities to chemotax, based on whether they were treated with 6-OHDA or not. This experiment evaluates the difference in the organism's response when the resting period following treatment is extended to twentyfour, forty-eight, or seventy-two hours.

Belmont University

P134 • Shannon Theobald, Marlee B. Marsh

Using Mab M24-2 (A Fish Lysozyme) to Examine the Host-Parasite Relationships in Livers of Fish From Saluda Shoals Park, Columbia, South Carolina

Fish innate immune responses are routinely evaluated as indicators of immune function and status following exposure to pathogens, biological response modifiers, immunotoxicants, and nutritional regimes. Recently, we developed monoclonal antibody (mAb) M24-2 that recognizes lysozyme in several species of fish (E.g. Fundulus heteroclitus, F. grandis, Ictalurus punctatus, Morone saxatilus) used in comparative immunological studies. Lysozyme is found in macrophages and neutrophils and is one of several humoral and cellular factors associated with innate immunity in all vertebrates. The purpose of this study was to use mAb M24-2 to examine cellular profiles of immune cells in livers of parasite-infected and uninfected livers of 41 fish from Saluda Shoals Park in Columbia, SC. There is no current model for fish immune responses to parasites. Furthermore, any direct role(s) of neutrophils and macrophages in fish immune responses to parasites has yet to be determined. This is mostly due to a lack of suitable reagents. In this study, we probe paraffin-embedded livers of several species of freshwater fish ((E.g. Lepomis spp., Ictalurus spp. and Micropterus spp.) and compare the lysozyme profiles of parasite-infected vs. uninfected individuals.

Columbia College

P135 •

A Study of Breast Cancer and Bone Density

The purpose of this study is to research bone fractures in early stage breast cancer patients in the southern United States region. In early stage breast cancer patients, many factors may contribute to a higher rate of bone fractures than in those that have not had breast cancer. Use of aromatase inhibitors, selective estrogen receptor modulators, luteinizing hormone-releasing hormone, chemotherapy, and radiation are a few of the factors that may contribute to higher bone fracture rate in cancer patients. In this study, the medical records of both estrogen positive breast cancer patients will be assessed. The focus of the study will be on estrogen positive breast cancer patients, but estrogen negative breast cancer patients will be used as a control group. Calcium and Vitamin D levels will be studied and compared to similar studies conducted in the northern region of the United States. Other sicknesses, deficiencies, or lifestyles that may contribute to bone fracture rate will be taken into account in this study. When research begins, data will be gathered from medical records. Data that will be gathered will include age, weight, gender, type and stage of breast cancer, treatments, medications, previous illness or injury, Calcium and Vitamin D levels, and bone density tests. This information will be compiled to compare altered estrogen levels found in early stage breast cancer patients to see the correlation to bone fractures.

P136 • Mahmud Hasan, Omar Bagasra

A Rational Design for Smallpox Post-Exposure Therapy in Case of Bioterrorism

Although, smallpox is completely eradicated there is always a possibility of a zoonotic epidemic and it still be used as a bioterrorism weapon. All poxviruses replicate in specialized cytoplasmic factories and have the ability to sequester necessary raw materials from the host including translation initiation factors. Our laboratory is investigating the potential use of microRNAS (miRNAs) that can be used a post translational silencing vehicles against smallpox in case of exposure to variola (the etiological agent of smallpox) or a chimera virus that can be used as bioterrorist attacks Our goal is to uncover miRNAs that can completely silence smallpox upon exposure to the deadly agent. Methods: We computationally analyzed the human miRNAs that show near perfect homology to smallpox and vaccinia viral genomes by sophisticated alignment tools. Results: We identified 26 miRNAs for variola and 23 miRNAs for Vaccinia that showed >90% homology with human miRNAs. Whereas, 13 miRNAs showed mutual homology with both viral genomes. Conclusion: We present evidence using bioinformatics

tools, and hypothesize that the utility of 26 miRNAs (i.e., hsa-miR-32-5p, hsa-miR-599, hsa-miR-103a-3p, hsa-miR-876-3p, hsa-miR-488-3p, hsa-miR-4647, hsa-miR-1264, hsa-miR-5186, hsa-miR-198, hsa-miR-6781-3p, hsa-miR-3128, hsa-miR-7161-5p, hsa-miR-3668, hsa-miR-338-3p, hsa-miR-3121-5p, hsa-miR-1205, hsa-miR-4789-3p, hsa-miR-548a-5p, hsa-miR-4528, hsa-miR-337-3p, hsa-miR-6824-3p, hsa-miR-545-5p, hsa-miR-4719, hsa-miR-3921, hsa-miR-33a-3p and hsa-miR-514b-3p can be utilized as a post exposure therapy in case of any kind of zoonotic or bioweapon chimera pox created as a weapon of mass destruction.

South Carolina Center for Biotechnology at Claflin University

P137 • Paul V. Cupp, Jr.

Long-Term Nest Site Fidelity in Some Male Green Salamanders, Aneides aeneus

Previous studies indicate that male and female *Aneides aeneus* exhibit site fidelity from one year to the next in their use of rock crevices, including breeding crevices. The present study examines the use of breeding crevices by A. aeneus males at field sites in SE KY over a 12-22 year period. Crevices in specific rock outcrops were monitored for the presence or absence of males prior to or during the deposition of eggs by females during the summer breeding period. Of the visible rock crevices with A. aeneus present, only a relatively few had brooding females with eggs. These crevices were often used every year or in alternate years over several years to brood eggs and hatchlings. Long-term site fidelity was shown by males (n=6) over a range of 4-13 years during which individual males were found in the same crevices in subsequent years at about the same time of year. Nest site fidelity by males may influence the continued use of these crevices. These crevices must have properties that result in their selection by males (and females?) as breeding sites.

Dept of Biological Sciences, Eastern Kentucky University, Richmond, KY

P138 • Carrie S. Schmaus, Margaret E. Ruppel, Adam C. Brown, Richard S. Phillips

Short-Term Impacts of PIT Tag Implantation in Captive King Snakes, Lampropeltis mexicanus

PIT (Passive Integrated Transponder) tagging is a common method of marking both wild and captive snakes. Although two methods of implantation are frequently used, subcutaneous implantation is often preferred to surgical abdominal implantation despite concerns of potential tag expulsion. To examine short term impacts of PIT tags, 36 captive king snakes, *Lampropeltis mexicanus*, were assigned to one of two treatments: tagged or injected. Each treatment had an even weight distribution. Using a 12 mm PIT tag and a reuseable syringe, the tagged group was implanted with the tags while the injected group received only the injection. All injection sites were treated with cyanoacrylate. Weights of each individual were recorded weekly for 5 weeks pre-treatment as well as 5 weeks post-treatment. Weight gain percentages did not differ for either the tagged or injected groups for 5 weeks pre-treatment ("Xpre-tagging = 4.42%; "Xpre-injection = 3.91%) or for 5 weeks post-treatment ("Xpost-tagging = 2.10%; "Xpost-injection = 1.78%). No tags were lost during the study and little movement of tags was noted. Data suggest subcutaneous injections present little short-term impact on Thayeri king snakes as evidenced by weight gain percentages. Long-term evaluation of PIT tag retention is ongoing.

Dept of Biology, Wittenberg University, Springfield, OH; ² Dept of Biology, Wittenberg University, Springfield, OH; ³ Dept of Biology, Wittenberg University, Springfield, OH; ⁴ Dept of Biology, Wittenberg University, Springfield, OH

P139 • Scott P. Jones, David R. Chalcraft

How Long Do Trade-Offs of Predator-Induced Phenotypic Plasticity Incurred as Larvae Impact Adults?

Many organisms have the ability to alter their morphology, behavior or life history in response to environmental cues. For example, many tadpoles can alter their morphology to better escape from predators. It is unclear, however, whether morphological changes

made by tadpoles in response to predators in their aquatic environment have negative consequences for later life stages when tadpoles become frogs or toads. To examine these potential consequences, we conducted an experiment where we 1) raised tadpoles of the southern toad in artificial ponds that had no predators, caged predatory dragonfly larvae, or caged predatory fish and 2) assessed morphological differences among these individuals during their larval and terrestrial juvenile stages. We assessed the performance of juveniles by raising them in penned enclosures and measured growth, survival and hopping ability. Larval toads reared with fish had shorter tails than those reared without predators. Toad metamorphs reared without predators were longer and had lower survival than those reared with dragonflies. After being added to the enclosures, there were no significant differences in number of toads, size, leg length, or hopping ability between toads reared in the three treatments. These data suggest that the consequences of larvae changing their morphology to escape predation disappear shortly after metamorphosis. These data need to be interpreted with caution because of the high mortality in the enclosures, which may have prevented the detection of differences due to small sample sizes.

Dept of Biology and Center for Biodiversity, East Carolina University, Greenville, NC

P140 • Marvin E. Brown¹, David R. Cann¹, Jessica L. Deer², Eran S. Kilpatrick³

Preliminary Results From a Herpetofauna Survey at Santee National Wildlife Refuge

The Santee National Wildlife Refuge (Santee NWR) is a 6070 hectare tract located in western Clarendon County, South Carolina adjacent to Lake Marion. The property is situated in the Atlantic Coastal Plain physiographic province and contains a diversity of terrestrial and wetland habitats. Santee NWR is divided into four management units: Bluff, Cuddo, Dingle Pond, and Pine Island, Multiple active and passive sampling devices were used from March 2013 - August 2013 to sample herpetofauna at nine intensive survey sites within the refuge. A total of 804 individual captures, representing 58 species, was documented for 44 survey days. Eighteen of these species were new records for Santee NWR. The majority of captures (80%) were recorded from the Bluff and Cuddo Units. The difference in capture rate across the refuge units was influenced by the large number of eastern narrow-mouthed toad (Gastrophryne carolinensis) captures in the Bluff Unit and variation in sample effort. A 170 hectare Carolina bay (Dingle Pond) and temporary isolated wetlands on the Cuddo and Pine Island units serve as important breeding habitats for Ambystoma opacum (marbled salamander), Ambystoma mabeei (Mabee's salamander), and Ambystoma talpoideum (mole salamander). Small isolated wetlands that provide breeding habitats for these salamanders have conservation value as they are not protected as jurisdictional wetlands. Based on current species distribution maps for South Carolina, an additional 25 species could occur on the property. Surveys in year 2014 will continue in addition to an assessment of multiple habitat variables at each established sample site.

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P141 • Austin H. Patton¹, Kristin A. Bakkegard²

Using Morphometrics to Distinguish Between Two Slimy Salamander Species in Central Alabama (*Plethodon glutinosus*, *Plethodon mississippi*)

The *Plethodon glutinosus* species complex is comprised of at least 13 species. When the group was first split by Highton, species ranges were approximated over large areas. Sampling did not fully account for Alabama's physiographic regions which often influences the distribution of the state's herpetofauna. The ranges of *Plethodon glutinosus* and *P. mississippi* meet in north central Alabama, where four of the state's physiographic regions also converge. Complicating matters is the cryptic morphology of these two species. We used geometric and linear morphometric methodologies and multivariate statistics to determine whether we could distinguish between each species and thus refine the range

of *P. glutinosus* and *P. mississippi* by classifying specimens from north central Alabama to their correct species. We found no difference in head shape between the two, but did find that *P. glutinosus* was significantly larger than *P. mississippi* in body size. This was unexpected, as geometric morphometric methods have been shown to be sensitive to subtle shape differences. It is possible that the ranges of these two species do not overlap or there is some other factor limiting interspecific competition that explains why no differences in head shape were found. Additionally, logistic regression was unable to satisfactorily classify unknown salamanders from contact zone counties. We recommend genetic studies be conducted to refine the ranges of these two species and to identify broad scale patterns of gene flow. Sampling should focus on the boundaries of Alabama's physiographic regions and across Alabama's major rivers.

Dept. of Biology, Warren Wilson College, Asheville, NC; Dept. of Biological and Environmental Sciences, Samford University, Birmingham, AL

P142 • Kristen Gillespy¹, Brielle Bowerman¹, John D. Wilson², Michael Dorcas¹

Confirmation of Python-Associated Declines in Mammal Populations in South Florida Using Automated Game Cameras

The Burmese python (Python molurus bivittatus) is native to southern Asia and is one of the world's largest snakes. Burmese pythons are now established firmly as an invasive species over a large portion of southern Florida. Since recognition as a reproducing population in 2000, the number of pythons found and their geographic range has expanded considerably. In 2012, severe declines in several once common species of mammals were documented that correlate both temporally and spatially with the proliferation of pythons. This study relied on the use of roads as transects to measure the relative abundances of mammals and compare those measurements to the temporal and spatial spread of pythons. To further evaluate mammal declines, we conducted a survey of mammal relative abundances using artificial turtle nests as potential mammal attractants, which were then monitored using automated game cameras. We found patterns of mammal relative abundances that negatively correlate with the spatial proliferation of pythons. Specifically, we recorded 174 raccoon observations and 32 bobcat observations in areas without pythons and no raccoon or bobcat observations in core python areas (i.e., Everglades National Park, where pythons have been established the longest). Opossums were approximately 7 times more abundant and deer were 11 times more abundant in areas without pythons. Rabbits were only observed in areas outside the python's range. In recently invaded areas, mammal populations were reduced but not as severely as in core sites. Our study confirms the apparent devastating effects pythons have had on mammal populations in South Florida.

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P143 • George W. Szarka III1, Thomas P. Wilson

Sampling Amphibians and Reptiles in Southeastern Tennessee: Lessons Learned and Implications for Conservation and Management

Amphibians and reptiles are imperiled throughout much of the southeastern United States; and, in an effort to combat these declines, rapid assessments (RA) have been used to develop adaptive conservation and management strategies. However, researchers are urged to standardized capture techniques and have a working knowledge of the target species life-history and ecology before conducting an RA. Practitioners cannot elucidate action plans that are forward-thinking without first addressing these points. Furthermore, without this level of understanding, we cannot effectively sample populations of rare or cryptic species or assess landscapes that have been under sampled. To this end, we collected data from two sampling periods fall (9/12/11 to 11/3/11) and spring (3/11/12 to 5/3/12) totaling 107 days at a wetland in Hamilton County, Tennessee. Data were analyzed to show the efficacy of various capture methods (e.g., drift-fences, pitfalls, funnel traps, and incidental captures). We developed a decision tree that incorporates life-history

data, literature, methodology, and associated costs. Using this decision tree and aforementioned methods, 15 amphibian species and 12 reptile species were captured, totaling 2,982 individuals. Funnel traps captured statistically more individuals than incidental captures with a t-test probability of .039 and a p-value <.05. Species captured by trap type are 15 for pitfall traps, 19 for funnels traps, and 20 for incidentals. Our study suggests that a combination of techniques that target specific species, habitats and timeframes can be as successful as studies of a longer duration.

¹ Environmental Science, University of Tn Chattanooga, Chattanooga TN

P144 • Taniya S. Mathew¹, Samantha L. Poarch¹, Callie C. Wolfe², Kirsten A. Work², Briget C. Doyle¹, Melissa A. Pilgrim¹

Sewer Line Salamanders: Sewer Pipeline Impacts on Spotted Salamander (Ambystoma maculatum) Breeding Activity

A current environmental challenge wildlife face is persistence through extreme anthropogenic habitat alterations and destruction. A common type of habitat alteration in Spartanburg County is the use of creek floodplains as placement sites for county sewer pipelines. An artifact of maintaining sewer pipelines is development of tire track depressions in dirt roads running alongside the pipelines that fill with water during periods of heavy rain, which provide potential amphibian breeding habitat. Our study presents pilot data focused on evaluating (1) the use of pipeline puddles as Spotted Salamander (Ambystoma maculatum) breeding sites, (2) the relationship between puddle size and salamander egg mass density, and (3) the relationship between puddle resource base (i.e., zooplankton density) and salamander egg mass density. We used visual surveys to count salamander egg masses in 22 puddles during the 2013 breeding season. In addition, we collected zooplankton samples from each puddle to serve as an estimate of food resources potentially available to salamander larvae. Our egg mass counts varied from 0 to 109 egg masses per puddle. A paired t-test indicated that the number of salamander egg masses in sampled puddles significantly increased during the course of our study (t = -2.579, df = 13, p = 0.022). Linear regression analyses indicated that egg mass densities were positively associated with puddle area (r^2 =0.69, p < 0.001) and zooplankton density (r^2 =0.22, p = 0.039). We discuss our results within the context of anthropogenic habitat alterations serving as either ecological traps surrogate/supplemental habitat for wildlife.

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P145 • Bryan D. Hudson, Carlos D. Camp

Thermal Characteristics of Shelter Rocks Used by Gravid Female Timber Rattlesnakes Crotalus horridus In the Appalachian Mountains of Northern Georgia

Thermal environments created by such retreats as shelter rocks can heavily influence both physiological and behavioral processes in ectotherms. For viviparous species, successful gestation of developing embryos demonstrates one critical physiological process for which suitable thermal retreats are often sought. Female Timber Rattlesnakes (Crotalus horridus), a viviparous species found throughout the Appalachian Mountains, rely on exposed rock outcroppings for gestation and birthing, using the same shelter rocks for both purposes. We investigated thermal characteristics of repeatedly used shelter rocks to determine if these sites represent unique thermal microhabitats. We chose six shelter rocks located in the mountains of northern Georgia and paired each with a nearby, seemingly suitable, unused rock as a control. We used data loggers to record temperature under each rock every 15 min across an entire active season. We randomly chose 50 data points for each rock for analyses. Because the data were normally distributed, we used a 2-way ANOVA, testing for differences among pairs and between treatments (used versus unused). There was no difference in treatments in mean temperature, although there were highly significant differences among pairs. The results of a test of equality of variance between the pooled gestation data and the pooled control data indicated a significantly

higher variance among the control data, although this pattern was not present for all rock pairs. Active behavioral thermoregulation by rattlesnakes throughout each day may preclude the need for reliance on unique thermal microhabitats associated with shelter rocks.

Dept of Natural Sciences, Piedmont College, Demorest, GA

P146 • Maria Davenport, John F. Moeller, Charles F. Smith

Assessment Behavior in Neonate Copperhead Snakes Is Correlated With Familiarity and Not Kinship

Reptiles have been traditionally viewed as asocial. However, recent evidence suggests that some squamate reptiles, notably pitviper snakes, may possess individual recognition capabilities, and in some cases aggregate in kin-based social groups. Such sociality requires individuals to recognize and remember one another over time. Here we describe a novel behavior in neonate copperhead snakes, *Agkistrodon contortrix*, that may function in individual recognition through chemoreception, the primary mode of communication in snakes. We tested whether the behavior (assessment) differs in duration and frequency between test groups composed of sibling and non-sibling pairs, either raised together or separately. Although the assessment behavior does not differ in duration when tested after six months of isolation, we found that naïve individuals perform the assessment behavior more frequently than do individuals having previous experience with one another. Our results suggest that recognition of individuals is correlated with interactions experienced during the first three weeks after birth and that those interactions can be recalled after six months.

Dept of Biology, Wofford College, Spartanburg, SC

P147 • Neil Choyce, Charles F. Smith

Reproductive Investment in Female Copperheads (*Agkistrodon contortrix*) at the Extreme of Their Northern Range: Do Large Females Produce Large Progeny?

Female investment in reproduction may entail trade-offs, i.e. energetic tradeoffs between current and future reproductive investment; neonate size versus neonate number and frequency of reproduction versus energy allocated at each reproductive event. Trades-offs may be more pronounced in ectotherms because their morphology, physiology, behavior, and reproduction are strongly tied to the environment, particularly in higher latitudes or elevations. While larger neonates have been shown to have better performance and higher survival rates, female viviparous snakes typically produce more neonates rather than larger neonates as female body size increases. We tested the hypothesis that increase in female body size results in the production of larger neonates, rather than more neonates, in northern populations of viviparous snakes (Viperidae: Agkistrodon contortrix) where ingress to hibernation occurs shortly after parturition (thus strong selection on neonate survival). Contrary to our hypothesis, an increase in female body size in A. contortrix does not result in larger neonates. Rather, larger females produce more neonates consistent with previous studies. Because thermal dependence of embryonic development is widespread among squamate reptiles, female copperhead snakes in northern latitudes may be constrained from producing larger neonates, (perhaps by extending gestation length), due to decreasing environmental temperatures in late summer months.

Dept of Biology, Wofford College, Spartanburg, SC

P148 • Callie C. Wolfe¹, Tyler J. Fisk¹, Sarah A. Smiley², Terence M. Farrell¹

The Effect of Prey Type on Foraging Behavior in Pigmy Rattlesnakes (Sistrurus miliarius)

Pigmy rattlesnakes are dietary generalists that consume amphibians, reptiles, mammals and centipedes. We investigated foraging in pigmy rattlesnakes in laboratory feeding trials using Ground Skinks (*Scincella lateralis*) and Florida Blue Centipedes (*Hemiscolopendra marginata*). We videotaped 15 field-collected snakes in 16 centipede and 15 skink trials. Rattlesnakes envenomated centipedes significantly more often than skinks and in 62.5%

of trials centipedes were consumed, whereas, skinks were eaten in only 26.7% of trials. There was no statistically significant difference in mean time to first strike between prey species. However, there was a trend towards shorter mean strike distance in centipede trials. Venom acted more slowly in centipedes resulting in a significantly longer mean period between the strike and the prey's last locomotion as well as a longer period between the strike and the initiation of ingestion of the prey. It also took snakes significantly more time to complete ingestion once it was started for centipedes than skinks. Unlike skinks, centipedes were frequently consumed while still alive and by the midbody region rather than head first. Head elevation was exhibited by rattlesnakes approaching centipede prey significantly more frequently than when approaching skinks. Many of the observed differences in foraging behavior appear to result from centipedes low susceptibility to rattlesnake venom and their potent retaliatory strikes. The behavioral plasticity exhibited by pigmy rattlsnakes in foraging may be crucial to their success as generalist predators.

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P149 • Chelsea S. Kross, Stephen C. Richter

Interactions Between Species in an Anthropogenically Altered Ridge-Top Wetland Ecosystem

Hundreds of wetlands have been constructed as permanent water sources in a ridge-top ecosystem in eastern Kentucky where there were naturally only ephemeral wetlands. Consequently, the ecosystem was colonized by an amphibian community of species with a larval period that requires a long hydroperiod (e.g., Newts) and many that are top amphibian predators. In contrast, the natural ephemeral wetlands support amphibians with a shorter larval period (e.g., Wood Frogs). Some ephemeral wetland species will breed in constructed wetlands; thus, there could be negative impacts on ephemeral species. Our objectives were to: (1) determine if species of the ephemeral and constructed amphibian communities interact, and (2) evaluate positive and negative impacts on these communities. We selected Eastern Newts (Notophthalmus viridescens) and Wood Frogs (Lithobates sylvaticus) to represent the constructed and natural amphibian communities. respectively. We sampled six constructed and six ephemeral wetlands throughout 2013 and 2014. We counted wood frog egg masses and estimated survival bi-weekly throughout the breeding season (February-May) at each wetland. Newt populations were sampled every two months (5 times) from May 2013 to January 2014. Individuals were measured and weighed to determine body condition and individually marked using visual implant elastomer for recapture. Data suggest that wood frog reproductive success is negatively impacted when eggs are laid in constructed wetlands. Newts in constructed wetlands with Wood Frog eggs had higher body condition. Understanding the impacts of how amphibian species interact as habitat loss and modification increase will continue to be critical for amphibian conservation.

Dept of Biological Sciences, Eastern Kentucky University, Richmond, KY

P150 • Christian R. Oldham, Leo Fleckenstein, Steven J. Price

Novel Application of Passive Integrated Transponder (PIT) Telemetry in Natricine Snakes

Passive Integrated Transponder (PIT) technology has proved to be a valuable tool for monitoring wildlife. Recent developments in this technology now allow for novel applications through PIT telemetry utilizing portable antennas. During the summer of 2013, we conducted PIT telemetry surveys and hand-capture surveys of Queen Snakes and Northern Water Snakes in Jessamine County, Kentucky. We found that efficacy of detecting marked snakes was significantly enhanced when employing a portable antenna rather than traditional search methods. We also noted similar detection rates or marked individuals between morning, afternoon, and night PIT telemetry surveys. We were able to track movements of individuals using the portable antenna to determine distances moved between detections. Our results demonstrate the utility of PIT telemetry using portable

antennas in a previously untested system and underscore the value and applicability of this technology in future behavioral and ecological studies.

Dept of Forestry, University of Kentucky, Lexington, KY

P151 • Daniel P. Ferons¹, Jane L. Guentzel¹, Andrew Heyes²

A Comparison of Whole Body Mercury Concentrations of Mummichogs (Fundulus heteroclitus) and Atlantic Silversides (Menidia menidia)

Scientific studies of mercury cycling in fish populations have primarily occurred in freshwater and open ocean environments. Relatively few studies have focused on mercury cycling within estuaries and the majority of these studies were conducted using laboratory conditions. Estuaries provide a unique environment that serves as an interface between freshwater systems and the open ocean. Additionally, they serve as a nursery for numerous commercial fishes, some of which have been linked to higher levels of mercury such as tilefish (Lopholatilus chamaeleonticeps), cobia (Rachycentron canadum), and king mackerel (Scomberomorus cavalla). Tilefish, cobia, and king mackerel will commonly prey on mummichogs (Fundulus heteroclitus) and Atlantic silversides (Menidia menidia) while in coastal estuaries. Mummichogs and silversides are forage fish that reside within estuaries and both species are tertiary consumers that feed on herbivores, secondary consumers, and detritivores. Although occupying the same trophic level, mummichogs are primarily benthic feeders while silversides are pelagic feeders. We plan to collect water, sediment, and fish samples quarterly over a one-year period. Sampling will include water parameters of pH, dissolved oxygen, salinity, temperature, total mercury, methylmercury, and nutrients. Sediment samples will be collected for total and methylmercury analysis. Mummichogs and Atlantic silversides will be collected for gut content and total and methyl mercury analysis. We plan to present our first sampling period from February 2014. We will investigate how water quality and sediment parameters may affect mercury concentrations in these two fish and how these fish contribute to the bioaccumulation of mercury in commercially important fish.

Dept of Marine Science, Coastal Carolina University, Conway, SC; ² Center for Environmental Science, University of Maryland, Solomons

P152 • Lauren G. Arona, Kevin M. Gribbins

Spermatid Morphological Changes During Spermiogenesis Within the Southern Bunchgrass Lizard, Sceloporus aeneus

Spermatid character descriptions during spermiogenesis are on the increase within the literature for reptiles. Recently, a study compared Sceloporus bicanthalis to S. variabilis and established 8 character differences between these species that are found within the same genus. The present study focuses on the events of spermiogenesis within an oviparous and seasonal-breeding lizard, Sceloporus aeneus. This lizard is the sister taxon to S. bicanthalis and we explored the question; do sibling species within a genus show differences in the ontogeny of spermiogenesis? Five lizards were collected in April 2012 from Toluca, Mexico. The testicular tissues were processed normally for TEM and analyzed to determine the ultrastructural spermatid changes that occur during spermiogenesis. The present data was compared to the spermiogenic information available for the viviparous and continuous breeding Sceloporus bicanthalis. Interestingly, few differences exist between S. bicanthalis and S. aeneus. Degrading and coiled myelin figures were visible within the developing acrosome, which are likely remnants of transport vesicles from the Golgi complex. Acrosome and subacrosome granules are present during early spermiogenesis. Throughout late spermiogenesis, an electron lucent line, the acrosome lucent ridge, between the subacrosomal space and the acrosomal medulla was seen in S. aeneus spermatids, which has been mentioned in other squamates but not accurately described. Our study suggests that spermiogenesis may be more conserved in sibling taxa within a genus. The significance of these findings is not known as too few lizards with the same genus and across taxa have been studied to date.

Biology Dept, Wittenberg University, Springfield, Ohio

P153 • Eric Tennant, Lori Henry, Heather J. Kalb

Effect of UVB Radiation and Different Temperatures on Growth in 500 Day Old Malayan Box Turtles (*Cuora amboinensis*)

We compared growth in hatchling Malayan box turtles raised with or without UVB light. UVB radiation allows the formation of vitamin D3 by the skin. Vitamin D3 can also be gained through the diet. The turtles in this study were fed Reptomin pellets which contain vitamin D3. We wanted to know if the UVB radiation was necessary for the successful rearing of Malayan box turtles when they were consuming a diet rich in Vitamin D3. Sixteen hatchlings were exposed to UVB radiation from 5.0 Reptisun lights with a minimum level of 20 mW/cm² for 12 hours per day for about 500 days. Another 16 turtles had the same UVB lights, but with a protective UVB sleeve that reduced the UVB output to 0. No significant differences were observed in carapace length, plastron length, width, height, weight, or density (weight/scl) (p>0.05). All turtles had firm solid shells. Turtles were housed on four vertically stacked shelving units. Each shelf housed turtles from both study groups. The higher shelves were warmer and had larger, hungrier turtles than the lower shelves. There were no significant differences between adjacent shelves, however the top shelf (1) and the next lowest (2) had significantly longer (CL), heavier, or wider (just tank 1 vs 4) turtles than the lowest shelf (4). The presence or absence of UVB radiation in this study had no effect on growth rates, while warmer temperatures caused an increase in growth rates and abnormal curling of the carapace.

Dept of Natural Sciences and Mathematics, West Liberty University, West Liberty, WV

P154 • Rachel L. Davis, Richard M. Austin

The Effect of Exercise on the Hydration Status of American Toads (Anaxyrus americanus)

Dehydration as a consequence of exercise can be a contributing factor to desiccation. Dehydration in anurans can lead to impairment of oxygen transport, necessary increased reliance on glycolysis, and diminished performance of both cardiac and skeletal muscle. We examined the relationship between exercise and water loss in American Toads (Anaxyrus americanus). We compared two treatments in mean water loss, a control group, in which subjects were restrained from exercise, and an experimental group, in which subjects were forcefully exercised. We weighed each specimen before and after each trial, which lasted 15 min, and interpreted weight loss during each trial as water loss. We then tested for differences in weight loss with analysis of covariance (ANCOVA), setting initial weight as the covariate. The results indicated no significant difference in water loss between exercised and non-exercised toads. This may be a result of the desiccation-resistant integument characteristic of toads.

Dept of Biology, Piedmont College, Demorest, GA

P155 • Ashley M. Bondurant

A Demographic Analysis of Student Carriers of Methicillin-Resistant Staphylococcus aureus In a College Community

Staphylococcus aureus is considered part of the normal flora of the human body in most individuals, but if left untreated it can cause serious health problems like pneumonia and endocarditis, making it the leading cause of skin and soft tissue infection. Overprescription of antibiotics, specifically beta-lactam antibiotics like penicillin and cephalosporins, has led to antibiotic resistant strains, one of which is methicillin resistant Staphylococcus aureus (MRSA). MRSA and Staphylococcus aureus are transmitted through hand-to-hand contact and contact with a contaminated surface. In this study, I have examined the prevalence of Staphylococcus aureus and MRSA on the High Point University campus by analyzing data collected from previous MRSA research teams and adding to the sample size using their same method by swabbing nasal passages of students. Over 600 samples were collected and grown on Mannitol Salt Agar (MSA) plates, a selective and differential media that differentiates Staphylococcus species. Positive samples were isolated and grown on MSA plates, and using the Kirby Bauer

method they were exposed to oxacillin discs (1 µm) and were defined as susceptible, intermediate, or resistant. Once all samples were collected, data was then compiled analyzing the demographics at High Point University based on the total student population size, gender and ethnic ratios, and affiliation with sports teams, clubs or Greek life. Future directions will be to monitor the trends of MRSA and *Staphylococcus aureus* infections on campus using statistical methods to determine if there were any trends associated with individuals who tested positive as carriers for MRSA.

Biology Dept, High Point University, High Point, NC

P156 • Katherine A. Rigby¹, Victoria J. Frost²

Antimicrobial Properties of Common Mullein (Verbascum thapsus) on Selected Bacteria Strains

Common mullein (Verbascum thapsus L., Scrophulariaceae) has been used by the Catawba Indians to treat illnesses such as, bronchitis, asthma, dry coughs, and other pulmonary issues. Earaches and inflamed skin conditions can be treated with an infusion of commercially available oil and mullein flower extract. There have been a number of reviews describing the use of plant extracts for medicinal purposes and some amount of published scientific data to verify the antimicrobial properties of this particular species of plant. The objective of this study was to further examine the possible antimicrobial activity of mullein leaf, flower, and stem extracts on five selected bacteria strains, including those in the genus Mycobacterium, using the disc diffusion method. The leaf extract was obtained by decoction and rotary evaporation while the flowers and stems were saturated in mineral, corn, and olive oils before being tested against the bacteria. Experiments were done in triplicate and zones of inhibition were measured and compared to antibiotic controls. Initial results have demonstrated that the flower extract obtained by olive and corn oil saturation has some inhibitory effects against bacterial growth. The leaf extract was effective against Mycobacterium smegmatis and Staphylococcus aureus. Further analysis aims to identify if these results are statistically significant and may give further explanation as to why this plant has been traditionally used to treat lung and skin

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P157 • Alec L. Perry, Dinene L. Crater

Disinfecting Properties of Vegetable Juices Against MRSA and Staphylococcus aureus

Methicillin resistant Staphylococcus aureus is a strain of Staphylococcus aureus that is resistant to a number of antibiotics, including methicillin. MRSA is a very aggressive bacterium that has been responsible for infections in humans associated with the hospital environment. Unfortunately, these infections are now occurring in increasing numbers and are no longer just associated with the hospital environment but rather places in everyday life such as gyms, schools, and prisons. It is important to find alternative methods to antibiotics that can disinfect the bacteria. It is also important with the increasing prevalence in everyday life to find possible remedies that are cheap and easy to make right in the comfort of your own home. In this study, I will be investigating the question of whether vegetable juices have antimicrobial properties against MRSA and S. aureus. For my hypothesis, I am predicting that onions and tomatoes will be able to disinfect MRSA and Staphylococcus aureus because they are both highly acidic vegetables. For my investigation, I chose ten different vegetables ranging in pH and color (broccoli, spinach, avocado, carrot, tomato, ginger, onion, cucumber, asparagus and celery) and extracted the juice with a blender. I grew Staphylococcus aureus and MRSA separately on plates and tested the effects over the course of two days using a disk diffusion method. Preliminary results indicate that onions and tomatoes were the only vegetables that seemed to have some isinfecting properties to them. Future experiments will include repeated experiments using the disk diffusion method, as well as studies on the effects of spraying the vegetable juices directly onto an area to disinfect surfaces such as gym equipment.

Dept of Biology

P158 • Olivia V. Fletcher, Dinene L. Crater

Essential Oils and Their Components Inhibit the Growth of MRSA

Generally, Staphylococcus aureus is a part of our normal flora, but some individuals carry MRSA--an opportunistic pathogen. Methicillin-resistant Staphylococcus aureus (MRSA) is any strain of S. aureus that has developed resistance to beta-lactam antibiotics. It is no more infectious than S. aureus but its resistance makes it difficult to treat when infections do occur. Exposing MRSA to even more antibiotics will simply hasten its developing resistance to more drugs. The purpose of this study is to examine the antimicrobial properties of Tea Tree Oil, Peppermint Oil, and Lemongrass Oil against a MRSA strain grown from a High Point University student sample. Preliminary data has shown that both S. aureus and MRSA are sensitive to all three of the aforementioned oils in a disk diffusion assay. The individual chemical components of each of these oils will be tested against S. aureus and MRSA in order to determine the organic compounds that are exhibiting the antimicrobial properties seen in these oils. With further research, it is possible that these oils and their components will serve as natural remedies to treat MRSA infections as well as constituents in potential disinfecting cleaners.

P159 • Lisa Ann Blankinship

Identification and Comparison of Antibiotic Resistance Patterns of Bacteria Isolated From the General Population, Freshman University Students, and Medical Care Facilities

Antibiotic resistance has become a world-wide problem within the medical community. Genes that convey drug and multi-drug resistance are spread generationally and through horizontal transfer between bacteria of the same and different species. As people conduct their daily lives, they will encounter bacteria that carry antibiotic resistance genes which can then be transferred to their normal bacterial flora. In this project, members of the general population and freshman university students were sampled. Medical clinics in the Shoals area were also sampled. Swabs were used to collect bacterial samples from hands (general population and university students) or commonly touched surfaces (pens, reading material, phones, etc.) within the clinic environment. Samples were grown overnight and bacteria were isolated. Isolates were identified using the Biolog generation III database and tested for antibiotic resistance by the Kirby Bauer method. All samples were tested against 19 antibiotics and one negative control. It is expected that there will be commonly isolated species of bacteria between the general population and university students and that some bacteria isolated from the medical facilities will also be found on members of the general population and university students. Antibiotic resistance to penicillin class drugs is expected to be high. The data generated from surveys such as this can be used by the scientific and medical communities to monitor drug resistance and, when necessary, discontinue use of a particular antibiotic or class of antibiotics.

Dept of Biology, University of North Alabama, Florence, AL

P160 • Alesha D. McNeese, Brian Burnes

Is Your Dirt Dirty? Proving Septic Tank Systems Have Less Nitrate and Nitrite Contamination Than Sewer Line Systems

Is your dirt dirty? Proving Septic line systems have less nitrate and nitrite contamination than sewer line systems Alesha D. McNeese, Dr. Brian Burnes Dept of Natural Sciences and Mathematics, University of West Alabama Livingston, AL 35470 *Abstract*. Nitrogen is a natural part of our environment and is essential for plants to grow. In excess, it can be extremely harmful to the environment. Nitrates and nitrites are in abundance anywhere human or animal waste is being biochemically degraded. Septic tanks and sewer systems are concentrated sources of nitrogen waste. In this study, we investigated whether septic tanks or sewage systems generate more nitrogen contamination in the surrounding soils.

We expected that the more controlled filtration of septic tank systems would produce less contamination than sewer line systems. Our results are consistent with our expectations, suggesting that soils near sewage systems receive higher levels of nitrate contamination than soils associated with septic systems.

Dept of Biological and Environmental Sciences, University of West Alabama, Livingston

P161 • Chase A. Manuel, Dinene L. Crater

The Analysis of 'Green' Cleaners to Inhibit Growth of MRSA

Staphylococcus aureus is a common bacteria which can be found in nasal cavities and can cause infections to humans. A much more dangerous form of this organism would be Methicilin Resistant Staphylococcus aureus (MRSA). With the amount of MRSA related-infections on the rise in the United States, the development of effective products that inhibit antimicrobial growth continues to be a highly researched topic. Scientists have tried to find an alternative method for disinfecting and cleaning surfaces that does not require the use of industrial chemicals that may cause harm to individuals. People have submitted their own recipes for making alternative cleaner on many blogs and websites, most containing similar ingredients. A difference between most was the natural oil of choice. To determine if these cleaners are effective against S. aureus and MRSA, a mixture of a select recipe was made and tested using the disc diffusion method. The cleaner used contains white vinegar, baking soda, borax (sodium bicarbonate), dish soap, tea tree oil, and warm water. Preliminary evidence shows inhibition against S. aureus. With evidence to show susceptibility, the next step will be to determine which ingredients in the cleaner contribute to its antimicrobial properties against S. aureus and MRSA.

Dept of Biology, High Point University, High Point, NC

P162 • Rosmely Hernandez, Lisa Ann Blankinship

The Effectiveness of Monotherapy Versus Combination Therapy on Antibiotic Resistant Klebsiella pneumoniae Isolated From Sputum Samples

The emergence of bacteria that cause nosocomial infections in hospital settings has become more prominent in the last few decades. Cases of Klebsiella pneumoniae, a gram negative bacterium that is a normal inhabitant of the human intestines, the nasopharynx, and an opportunistic pathogen of the immunocompromised are being diagnosed more frequently. K. pneumoniae produces an enzyme (KPC) that gives it the ability to become resistant to a variety of antibiotics including carbapenems, aminoglycosides, and others. In this study, K. pneumoniae samples were obtained from different medical facilities. Isolates of these samples will be identified using the Biolog system. The isolates will then be tested for antibiotic sensitivity to antibiotic combination therapy and monotherapy using the Kirby Bauer method. Standards of K. pneumoniae will be obtained from a supply company to serve as reference. To date, 28 colonies of non-identified bacteria have been isolated and are ready for further analysis. It is hypothesized that antibiotic combination therapy will be more successful in the inhibition of K. pneumoniae than monotherapy. It is also expected that K. pneumoniae will be more resistant to some classes of antibiotics including carbapenems and aminoglycosides. Data from this research will be shared with the local biological and medical community.

Dept of Biology, University of North Alabama, Florence, AL

P163 • Rebecca A. Carroll, Brian S. Burnes

Bacterial Count of Discount Ground Beef

Bacterial contamination of meat products has been an ongoing problem in the US. Consumer safety has been brought to the frontlines, with meat spoilage being one of the main causes of food poisoning. It is a common practice in retail grocery stores to sell expired meat for a discount price. In this study, we investigated the bacterial count of discounted ground beef using the Pour Plate Assay (Nutrient agar with 4% glucose). Studies prior to this have shown that bacteria count can multiply 40 folds within hours at

grocery store conditions. Our results support proving studies showing count on the discount ground beef can be higher.

Dept of Biological and Environmental Sciences; ² University of West Alabama, Livingston, AL 35470

P164 • Samantha P. McDougal, Brian S. Burnes

Beyond the 5 Second Rule: Is the Myth of Blowing on Food to Remove Bacterial Contamination Accurate?

In this study, the validity of the practice of blowing on food to remove bacterial contamination has been tested. Three various types of candy were dropped on the floor, picked up after 5 seconds, and then blown on and tested for removal or addition of bacteria. After the completion of this experiment, it was determined that blowing on food does not remove bacteria but, on the contrary, can add more bacteria. Myth Busted.

Dept of Biological and Environmental Sciences, University of West Alabama, Livingston, AL

P165 • Daniel R. Merrill, Karen Bernd

Comparison of Several Cleaning Regimes Effects on Bacterial Population Density, Composition, Antibiotic Resistance in a Community Setting

In our study, we investigate the effect of regimens with antimicrobial cleaners on bacterial population density, composition, and antibiotic resistance. We sampled populations from two college workout facilities and two classrooms. The gyms used an antimicrobial cleaner and a 5% hydrogen peroxide solution while the classrooms were not cleaned during the academic year. Weight benches and desk-seats that served male and female students were randomly collected with dry, sterile swabs at each location. Colonies were cultured on Tryptic Soy Agar and resultant colony forming units (CFUs) were recorded to determine population density. Replica plating was then used to determine the presence of S. aureus, S. epidermis, P. aeruginosa, E. coli, & H. influenza. Cultured strains were then tested with antibiotics shown to have a developed resistance. Cultured composition density, composition and antibiotic resistance among cleaning regimes. These findings will aid in examining the college's cleaning policies and inform future studies concerning the development of antibiotic resistance.

Davidson College Biology Dept

P166 • Avery B. Smith, Brian S. Burnes

Do Geese Contribute to the Amount of *E. coli* Found in Treated Sewage From the Cahaba Waste Water Treatment Plant?

Water quality is vital for the safety of human and animal life. Treated sewage water must be evaluated to ensure that the levels of bacteriareturning into the effluent water supply are acceptable. The Cahaba Waste Water Treatment Plant routinely checks the level of *E. coli* that are returning to the Cahaba River. Recent elevated levels of *E. coli* found in effluent water supply suggest possible *E. coli* contamination from geese that lived on the waste water treatment plant grounds. In order to test this, goose fecal, influent, effluent, and river water samples were collected and isolated by being streaked onto EMB agar. The *E. coli* were assayed by antibiotic resistance and classified using discriminate function analysis. We show that the geese did not contribute to the increase of *E. coli* found in the effluent water supply of the Cahaba Waste Water Treatment Plant.

Dept of Biological and Environmental Sciences, University of West Alabama, Livingston, Al.

P167 • Tamara C. Smoot, Brian S. Burnes

Exposure to Candida Species in a College Environment

Recent studies have shown that opportunistic mycoses are becoming a persistent public health problem, especially on college campuses. In this study we investigated the

prevalence of *Candida* on the campus of The University of West Alabama. *Candida* was recovered from various samples throughout the campus and identified to the species level. Our results for *C. albicans, C. tropicalis, and C. krusei* are consistent with previous studies. In this study we show that Candida species found are typical of the college environment.

Dept of Biological and Environmental Sciences, University of West Alabama, Livingston, AL

P168 • Essence Parrish, Brian Burnes

Transfer of S. aureus And MRSA From Gym Equipment to Hands

A concern with community acquired methicillin-resistant aureus has emerged because of the possibility that fomites may play a significant role in the transferal of S.aureus to humans. Aside from health care facilities (i.e., nursing homes, hospitals, etc.), studies have found that relatively large numbers of S.aureus were also found on shared equipment in community fitness centers. However, whether S.aureus and MRSA reaches the body on contact with the fitness center equipment remains unclear. The purpose of this study is to identify S.aureus and MRSA equipment-to-body transfer in a small community fitness center. Exercise equipment and the users of the equipment were sampled for S.aureus and MRSA before and after the equipment was used. A previous study at the same gym found that S.aureus and MRSA were present on 84% and 42% of surfaces, respectively. This study further examines the possibility that fomites may lead to the transmission of potentially infectious Staphylococcal species.

Dept of Biological and Environmental Sciences, The University of West Alabama, Livingston, Al

P169 • Joshua L. Postoak, Linda K. Husmann

Hydrogen Peroxide Production by Clinical Isolates of Enterococcus faecalis

Enterococcus faecalis is an important nosocomial pathogen of humans capable of causing infection in a variety of locations, including the urinary tract, endocardium, bloodstream, wounds, and areas compromised by indwelling medical devices. E. faecalis is also known to produce biofilm on both biotic and abiotic surfaces. Hydrogen peroxide production by E. faecalis is considered a potential virulence factor since it is expected to contribute to inflammation and host cell damage. Forty-five clinical E. faecalis isolates were assayed for hydrogen peroxide production using the Prussian blue reaction to determine if hydrogen peroxide production correlates with the site of infection or is associated with vancomycin resistance. We found no significant difference between invasive isolates (from the bloodstream) compared to isolates from various tissues or from urine in their capacity for peroxide production. We also found no significant difference between vancomycin resistant isolates compared to sensitive isolates. We did find, however, that addition of 0.6% alucose to the growth medium significantly decreases hydrogen peroxide production. Since alucose is known to promote biofilm formation, we hypothesize that hydrogen peroxide production may be down regulated during biofilm formation in vivo. Studies are ongoing to examine whether other growth conditions known to promote biofilm formation also affect hydrogen peroxide production.

Dept of Biological Sciences, University of Tennessee at Martin, Martin, TN

P170 • Eunbyeol Goh¹, Chelsea B. Sumner¹, Erin N. Byrd², Erik Hill², Sharon E. Mason¹, Michelle S. Thomas¹

Isolation and Characterization of Fluoroquinolone Resistant Gram-Negative Bacteria From Hog Fecal Samples

There are an estimated 10.1 million commercial hogs in NC and 9.4 million people. Hogs, sometimes treated with fluoroquinolones (FQ), generate vast amounts of fecal waste every year. Waste can be sprayed on farms; however, this results in enviornmental and public health concerns because of the potential exposure to antibiotic resistant bacteria. Humans may come in contact with these resistant organisms through ingestion of

contaminated food which may transfer resistance to human commensal bacteria. FQ are second-line antibioitics used to treat infections in humans. FQ resistance, gained through plasmids, may be transferred to other species of bacteria. The purpose of this resaerch is to evaluate the prevalence of FQ resistance and to characterize the genetic mechanism of the resistance in Gram negative bacteria from hog fecal samples prior to and after treatment with Enrofloxacin. These samples were cultures with and without selective pressure. Both pre and post treatment colony counts showed no significant difference in the number of resistant bacteria, suggesting low acquisition of resistance after a single treatment. PCR was used to screen resistant Gram negative bacteria for the presence of common plasmid mediated FQ resistance genes including: qnrA, qnrB, qnrS, and aac-(6')-lb-cr. Out of 27 Gram negative resistant colonies, 7 showed postiive results for aac-(6')-lb-cr gene, two for qnrA, and one for qnrB. Positive PCR products will be purified and sequenced to confirm the presumed resistance genes. Other possible mechanisms of FQ resistance for cultured Gram positive and Gram negative bacteria will be explored.

¹ Dept of Biological Science, ² Dept of Public Health: Campell University, Buies Creek, NC

P171 • Brian K. Handlon, Dr. Michelle Thomas

Metagenomic Analysis From Equus caballus Fecal Samples

A current focus of research is to identify novel enzymes within microflora communities that could be used to increase efficiency and lower operating cost of applications across multiple industries. The aim of this study was to construct a metagenomic library of the microflora community of intestinal bacteria from equine fecal samples in order to identify new novel enzymes. Fecal samples were obtained from horses fed a mixture of grain and perennial pasture and hay grasses. Several genomic DNA extraction and purification protocols were evaluated to include commercial kits and pretreatments prior to their use. A modified pretreatment method using bead beating with a lysis buffer containing high concentrations of sodium dodecyl sulfate (SDS), salt, and EDTA followed by a purification step using QIAamp columns resulted in the highest yield of DNA. This procedure was scaled up in order to obtain a large volume of purified DNA for downstream applications. Multiple electrophoresis techniques were evaluated for the best band resolution of large sized DNA fragments. Total genomic DNA was electrophoresed in 0.8% agarose with 1% polyvinylpyrrolidone (PVP) which resulted in the majority of the chromosomal DNA fragments being located between 23-33 kb. The DNA from this section of gel was extracted and used for the construction of a library that will be screened for novel enzymes. Currently, there is a need in the biofuel industry for cellulases which can aid in the production of ethanol. To identify clones expressing these enzymes, screening will be conducted on carboxymethylcellulose (CMC) agar plates.

Dept of Biological Sciences, Campbell University, Buies Creek, NC

P172 • Zainab Veerani, Brandi Baggett, Brian Seeblack, Julia E. S. Shearer

Plasmid Content and Identification of Environmental Bacterial Isolates From Northern Georgia

Bacteria are ubiquitous in the environment and frequently share genes by the horizontal gene transfer of mobile genetic elements, such as plasmid conjugation. Most bacteria carry plasmids, which encode adaptive genes for specific environments like virulence genes that aid in causing diseases, antibiotic resistance genes, and genes for alternate carbon sources. Class 1 integrons are usually found on plasmids and are associated with spreading antibiotic resistance genes; Class 1 integrons can be identified by the presence of *intl1*. We are interested in the plasmids carried by bacteria in our immediate surroundings, such as in the soil and in our food. We obtained soil samples from the GGC campus and isolated 16 bacterial strains. All isolates were identified as Gram-positive and were examined for plasmids. Fourteen out of 16 (87.5%) bacterial strains contained plasmids, 10 of which (71.4%) had plasmid bands that were larger than 30 kb, meaning large enough to possibly be conjugative. Eleven of the soil isolates were identified to the genus level by 16S rDNA PCR and sequencing. Total DNA extracted from the GGC soil

samples was negative for *intl1* by PCR, suggesting the absence of Class 1 integrons. Evidence of Class 1 integrons was found in food isolates. *intl1*-positive bacterial strains were isolated from organic store-bought chicken breasts. Two isolates were identified to the genus level by 16S rDNA PCR and sequencing and were examined for plasmid content, both containing plasmid bands >30 kb.

School of Science & Technology, Georgia Gwinnett College, Lawrenceville, GA

P173 • William C. Bible, Michael S. Glennon, David K. Giles

Scavenging of Fatty Acids Confers Phenotypic Advantages to Pseudomonas aeruginosa

Pseudomonas aeruginosa, a common opportunistic pathogen, is known to cause infections in a variety of compromised human tissues. Bacteria are extremely adept at adapting to their environmental and host niches. An emerging mechanism for microbial survival is the incorporation of exogenous fatty acids to alter the cell's membrane phospholipid profile. The goal of this research was to examine P. aeruginosa's ability to utilize exogenous fatty acids in a manner that affects its growth and survival. Initially, potential phospholipid alterations in response to pH, temperature, and salt concentrations were examined. Then, a range of host-derived fatty acids not native to P. aeruginosa were added individually to cultures. Bacterial phospholipids were extracted using the Bligh and Dyer technique and examined using thin layer chromatography (TLC). Whereas minor phospholipid alterations were observed in response to various environmental stresses, growth of P. aeruginosa in the presence of linolenic and arachidonic acid resulted in the assimilation of the fatty acids into membrane phospholipids. High performance liquid chromatography (HPLC) was performed to confirm new phospholipid profiles that had been observed by TLC. The potential survival advantages conferred by this phenomenon were examined by exposing P. aeruginosa to several physiologically relevant stresses such as acid stress, salt stress, and resistance to antimicrobial peptides. Preliminary results indicate that P. aeruginosa is gaining survival advantages due to its ability to incorporate exogenous fatty acids.

Dept of Biological and Environmental Sciences, The University of Tennessee at Chattanooga, Chattanooga, TN

P174 • Lauren M. Dehnart¹, Devanshi Patel¹, Kevin M. Andres², Virginia A. Young¹

Isolation and Identification of Bacteria Surviving in the Presence of the Long-Term Antimicrobial Protect 'N Shield

This is a continuation of last year's study of the efficacy of Protect 'N Shield on collegiate wrestling mats. There are two elements to this study; the first part served to monitor the colony forming units (CFUs) surviving on the wrestling mats throughout the year to validate last year's study. We continued to sample the mats treated with Protect 'N Shield and the untreated mats both before and after mopping with Maxima 135, in an effort to monitor growth trends throughout the semester to test our previous conclusion that Protect 'N Shield should be applied twice a semester at minimum. The second part was investigative; bacteria surviving in the presence of Protect 'N Shield were isolated, identified, and tested for antimicrobial resistance. We selected colonies that visually resembled *Staphylococcus* species, and then performed biochemical tests to confirm the identity of the isolates. After identification, we tested for resistance to the cleaning agent Maxima 135 and to antibiotics to determine if the surviving bacteria represent a health concern to the wrestlers. The efficacy of Protect 'N Shield on the wrestling mats, the species identification of isolated colonies, and the results of drug resistance tests on the isolates will be discussed.

¹ Dept of Biology, Mercer University, Macon, GA; ² University Athletics, Ottawa University, Ottawa, KS

P175 • Stephen E. Hayes, Michelle S. Thomas

Determination of GC Content for BGP-2 Using a Real Time Thermocycler

In bioremediation, surfactants are used to emulsify hydrocarbon pollutants in water to make the hydrocarbons more accessible for breakdown by bacteria. Identification of bacterial species that have surfactant resistance is essential for the advancement of bioremediation techniques. One bacterial species, BGP-2 was isolated from Nereis succinea with the intention of being utilized for bioremediation due to its high surfactant resistance. Prior characterization of BGP-2 has shown that BGP-2 is a new species. To complete the classification of BGP-2, its GC content must be determined. Common methods for analyzing GC content include mass spectrometry and HPLC; both of which require training and access to equipment that are not readily present in biological laboratories. With increasing access to quantitative real time PCR thermocyclers, applications such as determining GC content have been devised. To assist in the classification of BGP-2, a standard curve of bacteria with well-known GC contents was generated using a Step One real time PCR thermocycler. We expect that experimental data from BGP-2 can be applied to the standard curve in order to determine its GC content. With knowledge of BGP-2's GC content, it will be possible to place BGP-2 into a taxonomic rank.

Dept of Biological Sciences, Campbell University, Buies Creek, NC

P176 • Nicole L. Adams, Wayne Rossiter

Dilution Effect Explains Prevalence of Infection in a Model Trematode-Snail System

Much literature exists regarding trematode-snail relationships, and several of those studies indicate that habitat is highly correlated with heterogeneous patterns in the prevalence of infection. While hypothesized in other work on parasite aggregation, dilution effects (where habitat size dictates the density of infective stage larvae per unit area) is rarely experimentally tested. This study directly investigates the relationship between habitat area and parasite aggregation in a model trematode-snail system. Previous work has demonstrated habitat-specific infection patterns in two trematode species (Himasthla quissetensis and Zoogonus rubellus) infecting the Eastern mudsnail (Ilyanassa obsoleta). In this study, we selected eight intertidal pannes (ranging in sizes from 5-50 m²) and surveyed the standing infections by sampling 100 snails from each panne in July, 2013. In each panne, we then installed three caged enclosures containing 50 uninfected snails each, and left them to accumulate new infections until late September. We predicted that smaller pannes would produce higher prevalence values than larger ones. Both sets of snail collections were then measured for size and parasite load. A partially completed dataset suggests that snails in small pannes are more prone to higher parasite loads (reaching 84% prevalence values), supporting the idea that these two trematodes can saturate small areas with infective stage larvae.

Dept of Biology, Waynesburg University, Waynesburg, PA

P177 • Alexandra T. Griffith, Wayne Rossiter

Diel Patterns of Parasite Larvae Production and Host Mortality in a Snail-Trematode System

Numerous studies have quantitatively reported on the production of parasite larvae with respect to individual hosts. The literature addressing trematode-snail patterns is particularly robust. Still, little attention has been given to the remarkable variation in larval (cercariae) production among individual hosts, or in the same host through time. In this study, we assessed patterns in the number of cercariae released by infected individuals on a day-to-day basis for trematodes infecting the mudsnail *llyanassa obsoleta*. We found that the variation in diel release of cercariae (SD = 189.97) was larger than the magnitude of mean cercarial production (184.67), and production ranged from 0-1476 in a single day. Patterns of larval release were not correlated among snails. As an extension of previous work on this system, we also experimentally evaluated the survivorship of infected individuals verses the uninfected individuals under stresses consistent with real

environmental extremes. We found infected snails were more likely to die in situations of elevated temperature and salinity than those that were uninfected. This suggests that the infection has a negative effect on the survivorship of the snail, and might explain previously reported distribution of the parasite in host populations.

Dept of Biology, Waynesburg University, Waynesburg, PA

P178 • Brandon Denney, Riccardo Fiorillo

Seasonal Dynamics of Trematode Parasites of Three *Elimia* Species (Gastropoda: Pleuroceridae)in the Etowah River Basin in Northwest Georgia

We examined the seasonal dynamics of the trematode parasites of Elimia modesta, E. carinifera, and E. carinicostata in the Etowah River basin located in Northwest Georgia. Approximately 400 snails were collected monthly from September 2013 through March 2014 from each of four locations in three small tributaries of the Etowah River (Euharlee. Two Run, and Connesena creeks). In the laboratory, snails were isolated in wells with approximately 60 ml of spring water and examined for actively shedding trematode cercariae two or more times over a three week period. Overall, we identified 13 cercariae morphotypes, Snails in Connesena Creek showed the highest trematode species richness and were infected with all morphotypes, while snails in Euharlee Creek, were only actively shedding 7 morphotypes. Cotylomicrocercous cercaria, shed by trematodes in the family Opecoelidae, was the most prevalent larval trematode and found in three of four sites. Prevalence of this trematode was lowest in our late summer collection and increased through fall and winter months. We also report on the seasonal prevalence of all remaining morphotypes and their patterns of occurrence across all sites. In addition, we also examined the seasonal prevalence of a commensal annelid, likely Chaetogaster limnaei limnaei and noted a positive correlation between annelid and trematode prevalence across collection sites.

School of Science and technology, Georgia Gwinnett College

P179 • Suzanne Scott, Riccardo Fiorillo

Survey of the Trematode Parasites of Two Pulmonate Snails, *Micromenetus dilatatus* and *Physa gyrina*, From a Retention Pond in Gwinnett County, Georgia

We surveyed the trematode parasites of two pulmonate snails, Micromenetus dilatatus and Physa gyrina, from a retention pond adjacent Georgia Gwinnett College. Snails were collected from February to October 2013, and isolated in 5 ml wells of aged tap water. Within 48 hrs, snails were checked for shedding cercariae, which were identified to morphotype. Data showed prevalence greater in M. dilatatus (44%)than P. gyrina (5%). We recovered 7 cercariae and 2 metacercariae morphotypes. Micromenetus dilatatus was the most abundant snail during winter and early spring, but its abundance declined sharply in late spring and summer and none were collected in fall. Trematode prevalence was high in winter and early spring and peaked in April (75%), We collected 5 cercariae morphotypes and 1 metacercaria. Physa gyrina was collected throughout the survey, most commonly in February and October. This snail was host to 6 cercariae morphotypes and 1 metacercaria. Snails were not infected in winter, and although trematode prevalence peaked in May (10.5%), in October snails harbored a more species rich trematode community. Most common cercaria overall, and in M. dilatatus, was an ArmateXiphidiocercaria. This morphotype belongs to trematodes in the families: Telorchiidae, Plagiochiidae, Auridistomidae, Ochetosomatidae, and Cephalogonimidae and, as adults, they infect amphibians and reptiles. A Brevifurcate-Apharyngeate Furcocercous cercaria was the most common parasite in P. gyrina and belongs to trematodes in families: SpirorchiidaeandSchistosomatidaewhich as adults infect reptiles, and birds/mammals, respectively.

School of Science and Technology, Georgia Gwinnett College, Lawrenceville, GA 30043

P180 • Elliot J. Boerman, Melba Horton

Carbon Dioxide Uptake of Various Brassica oleraceae Cultivars

Cultivars of the Brassica oleraceae species form an important part of the human food crop since ancient time. Brussels sprouts, broccoli, and kale are members of the Acephala, Italica, and Gemmifera groups, respectively that have been shown to provide essential nutrients that are linked to reduce the risk of human cancers. The primary objective of this study is to determine if there is a significant difference between these cultivars in their carbon dioxide utilization. It is hypothesized that the different cultivars don't vary in their CO² uptake. To test this hypothesis, an experiment was conducted. Each plant cultivar (~6 week old seedling) was placed in a sealed container with a CO2 meter used to measure the changes in CO2 at 10 minute interval for an hour. This was repeated 3x with a new plant used each time to serve as replicates. The CO2 content of the sealed container without plants was also measured to serve as control. Using analysis of variance (ANOVA), results of the experiment indicated that Brussels sprouts consumed the highest amount of CO₂ within an hour, followed by broccoli, and the least uptake by kale (p<0.05). This rejected the null hypothesis indicating that the three cultivars from the same parent population of wild mustard vary in their CO2 uptake. This implies that the cultivars are manifesting physiological variability and whether this is an adaptation that has some evolutionary implications needs further investigation.

Biology, University of North Georgia, Dahlonega, GA

P181 • Megan F. Brinkerhoff, Melba Horton

Effect of Varying Light Exposure on House Mice (Mus musculus) Food Consumption

The common house mice, Mus musculus, are nocturnal animals which exhibit sensitivity to light. Mice infestations and the damage they bring to properties and more importantly to human health had been widely reported. This experiment was conducted to determine the effect of varying light exposure on house mice to their food consumption. It is hypothesized that the amount of light exposure has no effect on the amount of food consumed by house mice. To test this hypothesis, three mice of approximately the same size were placed in each of three cages. One cage was exposed for 8 hours, and the other 2 for 12 and 20 hours of light a day for two days. After each exposure period, the cages were covered with black cloth to ensure total darkness. Each cage was provided 24 grams of commercially purchased mice food. At the end of the 2-day light exposure period, the remaining food was weighed and the difference was used as the total food consumed. Results of the T-test showed that mice exposed for 20 hours of light consumed significantly the least amount of food (p<0.05) while those in 8 and 12 hours did not show a significant difference (p>0.05). It is therefore concluded that the food consumption of house mice is significantly affected by light exposure which ultimately rejects the null hypothesis. This implies that lighted areas will probably have lesser likelihood of damage caused by mice infestation than darker environments.

University of North Georgia

P182 • Miranda N. Dey, Caleb W. Phillips, Benjamin R. Montgomery

Petals Abscise Earlier Under Hot, Dry Conditions for Linum rigidum, a Dry Prairie Species

Linum rigidum (stiff flax) is a small plant which grows in moisture limited habitats, but it has large petals that may substantially increase water loss. Perhaps, as a consequence, the corolla typically abscises in the afternoon, a few hours after opening. Three studies were conducted in order to examine the effect of weather conditions on time of petal abscission. First, we used a fan in a screen-house with little natural breeze to test the effect of wind speed (0, 3, or 6 m/s) on the time of petal abscission. The study did not show a significant influence of wind speed but did suggest an effect of humidity. Next, we found that in a humidity-controlled growth chamber, petals abscised earlier at low humidity (40%) than high humidity (80%). The third study investigated the relationship between petal abscission and natural variation in weather conditions including our wind study and

two earlier studies in 2012 and 2013. Time of petal abscission was compared to several weather-related variables including temperature, relative humidity, and wind speed. We found that petals abscised earlier on hotter days, and there was some trend for petals to abscise earlier on dry days with high evaporative potential. Our data indicate that *Linum rigidum* petals abscise earlier under dry hot conditions, which suggests that early petal abscission functions to reduce water loss.

Division of Natural Sciences and Engineering, University of South Carolina Upstate, Spartanburg, South Carolina

P183 • Matthew M. Haines¹, Melba Horton²

Timeliness of Stomatal Apparatus in Tradescantia zebrina

Leaves of Tradescantia zebrine, commonly called Wandering dew or Spiderwort, are widely used for investigations of stomata in the laboratory. The opening and closing of these apparatuses indicate the time of day when plants are able to carry out photosynthesis. This study aims to determine at which time of day the stomata of spiderwort leaves are either opened or closed. It is hypothesized that all stomata are open during daylight and all are closed at night. During each investigation, two leaves were obtained from each of the 3 Spiderwort plants grown in the UNG greenhouse. Five square millimeters of the underside of each leaf were cut and used as the sampling area to count the number of stomata. This was done in the morning (8°clock), at noon (1°clock), and evening (9 oclock) for three different days to serve as replicates. Counting was done under a light microscope at 400x total magnification. Results showed that about 85% of the stomata are open in the morning and noon times but 15% were closed. Similarly, at night about 88% of the stomata were closed but 12% were still open. These findings rejected the hypothesis. This suggested that although most of the stomata in spiderwort behave as expected of a typical C3 plant, other factors seem to influence the timeliness of some stomata opening and closing which may have an impact on the plant's physiology.

¹ Unversity of North Georgia

P184 • Zoe Kempton¹, Amanda Long¹, Katie McDermott¹, Valentina I. Ochoa Mendoza¹, Gabriel I. Herrick¹, Celina M. Bellanceau¹, Neal Halstead², An-Phong Le¹

Two Species of Native Florida Butterfly Have Varying Response to Egg Deposition on Native and Non-Native Pipevine *Aristolochia* Spp.

During the course of breeding two species of native Florida butterflies, we have observed that Battus polydamas seems to have a wide tolerance for different species of pipevine Aristolochia sp.), being able to feed on both native and non-native plant members of this genus. Alternatively, B. philenor eggs deposited on non-native Aristolochia results in dispersal in search of a more suitable food source and/or lower survival. These observations suggest that the larvae of these two native Florida butterfly species have differing tolerance ranges for eating native versus non-native Aristolochiaplants. Our goal is to test the hypothesis that levels of the nephrotoxic and carcinogenic aristolochic acid are higher in non-native Aristolochiaspecies, causing reduced survival in B. philenorlarvae. We are currently using HPLC to quantify the relative concentrations of aristolochic acid in four species of Aristolochiato test this hypothesis. Furthermore, we are rearing both B. polydamasand B. philenoron native and non-native species of Aristolochia. We predict greater survival and size of larvae over time, shorter time to pupation and a greater rate of successful emergence of B. philenoron the native species compared to the non-native species of Aristolochia, confirming our initial observations in the field. Results can have a positive conservation impact by highlighting the importance of propagating native Aristolochia species in Florida, which should increase viability of B. philenor populations.

¹ Biology, Florida Southern College, Lakeland, FL; ² Dept of Integrative Biology, University of South Florida

P185 • Seth D. Worley¹, S. Douglas Kaylor¹, M. Joseph Hughes²

Stressed Fraser Fir Trees Prioritize Photosynthetic Capacity Over Other Functions

We asked if Fraser Fir (Abies fraseri) compensates for stunted needle morphology by increasing photosynthetic pigment density. Fraser fir, along with red spruce (Picea rubens), are co-dominant species in the cloud forests of the Great Smoky Mountains National Park, and are affected by a variety of stressors including acid and nutrient deposition, climate change, and the balsam wooly adelgid. Shoots in full sun were collected from 222 Fraser fir trees in 37 locations, with the different sites capturing the range of Fraser fir in the Park as well as elevational and stress gradients, with different needle morphologies observed during collection. To quantify morphology, the needles were scanned using a flatbed scanner and measured using MIMSI, a Matlab program that measures area, perimeter, length, and width of individual objects in images. The needles were then analyzed for chlorophyls a and b and carotenoid content using a methanol extraction. We found that smaller needles had more pigments per gram than larger needles, but not more pigments per unit area. This means that stunted needles have proportionally fewer non-photosynthetic compounds than healthy needles. From this we conclude that stressed trees prioritize photosynthetic capacity over secondary functions performed by other compounds.

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P186 • A. Calan McKinney¹, M. Joseph Hughes¹, S. Douglas Kaylor²

Can We Visually Inspect the Needles of Fraser Fir to Estimate an Indicator of Shoot Health?

Abies fraseri (Fraser fir) is the dominant tree species in the high elevation forests of the Southern Appalachian mountains. The future of *A. fraseri* populations remains uncertain; the species is showing signs of decline in health and increased mortality throughout its range. Current physiological assessments require expensive and bulky equipment; the ability to quickly assess shoot function using a visual inspection could be a useful tool in projects where a health category would be sufficient.

Needles from *A. fraseri* were collected from five mountaintops in the Great Smoky Mountain National Park, representing most of its native range. Maximum photosynthetic rate, an important measure of leaf function, was measured in the field using a LICOR infrared gas analyzer. In the lab, needles were imaged using a flat-bed scanner and measured using MIMSI, a computer program for measuring the area, length, and width of individual needles. A visual inspection of shoots was also performed, wherein each shoot was scored by color, needle density, and necrosis, and categorized as Normal, Skinny, Blunted, or Dying. We were surprised to find that neither needle morphology nor visual characters predict maximum photosynthetic rate. Indeed, even dying shoots had similar maximum photosynthetic rate to normal needles. Therefore a visual inspection is not sufficient for assessing shoot health.

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P187 • Susan Jones - Held1, Michael Held2

Early Growth of Thellungiella Salsuginea (Ecotype Yukon) in Response to Excess Iron

Thellungiella salsuginea (salt cress) is tolerant to abiotic stresses such as drought, cold and salinity unlike its glycophyte relative, *Arabidopsis thaliana*. Due to its tolerance to these stresses we were interested in examining the effects of altering iron levels on early growth of *Thellungiella*. The Yukon ecotype of this species grows on alkaline soil. The solubility of iron can be limiting on alkaline soils. Salt cress seedlings had reduced root growth when grown on half-strength MS macronutrients supplemented with excess iron [100 μM Fe⁺² or Fe⁺³] although the reduction in root growth was more pronounced with Fe⁺². Similarly, *Arabidopsis* exhibited reductions in root growth at these Fe concentrations, but not to the same extent as salt cress. In contrast to *Arabidopsis*, salt cress seedlings

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accumulated less Fe. The source of Fe did have an effect on the extent of Fe accumulation in both species. When Fe was supplied as Fe⁺², total Fe was greater than in seedlings treated with Fe⁺³. Also, the patterns in extracellular pH changes in response to the different Fe sources were different between *Thellungiella* and *Arabidopsis*. These differences will be discussed in relation to iron acquisition and metabolism.

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P188 • Charles P. Fyfe II, Eric M. Benfield, Kristy Y. Johnson

Long-Term Study of Cortisol as a Biomarker for Chronic and Acute Stressors

Stress has often been referred to as the silent killer of humans. Over long periods of time, stress can increase the chance of heart disease, high blood pressure, and irregular heartbeat. In part, these negative health effects can be attributed to the physiological effect of prolonged exposure to high levels of cortisol, a steroidal hormone that increases rapidly in the bloodstream in response to both acute and chronic stress. While transient elevations of cortisol in the blood have been studied extensively, it has only recently been shown that cortisol deposited in growing hair is an accurate reflection of a systemic concentration over a long period of time. We are conducting our study at The Citadel, a military college known for its rigorous regimented lifestyle and stressful fourth-class system for freshman cadets. We have collected hair samples from a mean sample size of 16 freshman cadets before they matriculated at The Citadel and have continued to collect weekly hair samples, along with a corresponding weekly questionnaire detailing their weekly cadet activities, academic activities, and perceived weekly stress. We are using an extraction protocol and enzyme-linked immunoassays to measure the cortisol levels from each sample. We will then analyze the data and search for long-term correlations between the cortisol concentrations before and after matriculation, along with the details of the questionnaires. In our analysis, we will consider the fourth-class system as a chronic stressor and weekly events as acute stressors.

Dept of Biology, The Citadel, Charleston, SC

P189 • Julia Oakley, Claudia M. Williams

Measuring Changes in Blood Vessel Diameter in the Tail of the Goldfish (Carassius auratus)

Blood flow to tissues can be regulated by dilation and constriction of vessels, and these changes in vessel diameter may be caused by localized or systemic factors. Previous studies on the observations of vasodilation and vasoconstriction of blood vessels are common, however most research does not show changes as specific measurements of vessel diameter. This study measured changes in the diameter of arterioles and venules in the tail of the Goldfish, *Carassius auratus*, using microscopy and Imagej software. Localized changes were caused by variations in temperature, with heat causing an increase in vessel diameter and cold causing a decrease in vessel diameter. Systemic changes were caused by epinephrine or acetylcholine transported through the gills into the bloodstream. Preliminary measurements show that epinephrine increased vessel diameter and acetylcholine decreased vessel diameter. This study is a model for future studies focusing on measuring quantitative changes caused by chemicals in freshwater habitats.

Campbell University, Buies Creek, NC

P190 • Taylor E. Spillman¹, Finn B. Fürstenwerth¹, Duncan D. Cameron², Jay F. Bolin¹

Isotopic Investigation of Mycoheterotrophy in the Southern Blue Thread(Burmannia capitata)

The Burmanniaceae contain several lineages of achlorophyllous mycoheterotrophic plants that may associate with arbuscular mycorrhizal fungi (AMF). Here we investigate the isotopic profile of a green and potentially mycoheterotrophic wetland plant in situ, Burmannia capitata, the Southern Blue Thread, and associated vegetation. We generated δ^{13} C and δ^{15} N stable isotope profiles of a population of *B. capitata* from the Sand Hills

Game Lands in Scotland County, North Carolina. The shoots of *B. capitata* are indistinguishable from other C3 reference vegetation but did show significant depletion in $\delta^{13} C$ relative to C4 reference vegetation. The highest $\delta^{15} N$ values were observed in the *B. capitata* shoot. The $\delta^{13} C$ signal of *B. capitata* root fraction was significantly enriched relative to the root fraction, suggesting a signal from mycorrhizal associates. Within the genus Burmannia transitions to full mycoheterotrophy have occurred numerous times suggesting that some green Burmannia species are likely partially mycoheterotrophic. Further investigations of mycorrhizal associate using isotopic, molecular and microscopic methods are planned.

¹ Dept of Biology, Catawba College, Salisbury, NC; ² Dept of Animal and Plant Sciences, Sheffield, UK

P191 • William Wright, Maria B. Davenport, Stacey Hettes

Lateral Hypothalamic Glutamate Receptors Mediate Predation of Crickets by Sprague-Dawley Rats

Recent studies linking the periaquaductal gray and superior colliculus to the lateral hypothalamus (LH) have shown all three regions contribute to regulation of predatory hunting. These findings suggest a possible role for LH neurons in regulating hunting behavior in addition to their well-established role in regulating feeding behavior. Our lab has demonstrated that inactivation of LH glutamate receptors with the NMDA receptor selective antagonist D-AP5 disrupts eating and foraging for rat chow. The current study examined whether bilaterally injecting 300nl volumes of the D-AP5 (50 or 10nmol) or artificaial cerebrospinal fluid (aCSF) into the LH of food deprived rats (n=12) would disrupt hunting and consuming crickets. Rats' behavior was continuously recorded upon placement in a 33 x 16 x 12 plastic tank with crickets. Both 10nmol and 50nmol doses of D-AP5 significantly reduced percent time spent hunting to 5% and 6% respectively compared to the aCSF control of 17% (p<0.001, by RM ANOVA and Student Newman Keuls). Percent time eating was also reduced for both 10nmol and 50nmol doses of D-AP5 to 14% and 9% respectively compared to the aCSF control of 25% (p<0.05). The average number of crickets eaten was also reduced for both 10nmol and 50nmol doses of D-AP5 to 12 and 10 respectively compared to the aCSF control of 25 (p<0.05). These results suggest the activation of NMDA receptors in the LH plays a critical role in the neural circuitry involved in regulating both eating and hunting.

Dept of Biology, Wofford College, Spartanburg, SC

P192 • W. Scott Fravel¹, Nicole M. Hughes¹, William K. Smith²

Thermogenic Effects of Anthocyanin Pigments in Evergreen Leaves

One of the earliest proposed functional hypotheses of leaf reddening was that (red) anthocyanin pigments increase absorption of visible radiation by leaves, thereby increasing leaf temperature. Studies testing thermogenic effects of red pigments on leaves have thus far failed to demonstrate any measurable difference in temperature between anthocyanic and acyanic tissues. However, most reported measurements of leaf temperature have been made without controlling for variables known by biophysical ecologists to ameliorate elevated leaf temperature (TLeaf) effects, such as wind, solar irradiance, and transpirational water loss, and none have examined leaves under cold winter conditions (when thermal conductivity of air is lowest). Here, we use a published model for leaf temperature to predict the environmental conditions under which a difference in leaf temperature between red and green leaves could occur, and use field observations to test our predictions. Environmental sensors paired with data loggers were used to simultaneously record the following variables: TLeaf, TAir, wind speed, and solar incidence of similarly sized red and green evergreen leaves of Galax urceolata during winter 2013. In all experiments, petroleum jelly was applied to the abaxial leaf surfaces to inhibit transpirational effects. We demonstrate that red leaves can exhibit significant (i.e. 1-7°C) increases in T_{Leaf} relative to green leaves of comparable sizes under bright, cold, low wind conditions. These results suggest that anthocyanin pigments in evergreen leaves ASB Poster Abstracts 413

could function to elevate leaf temperatures, which would provide a substantial physiological advantage during cold winter months.

P193 • Brittany P. Twitty, Benjamin R. Montgomery

Factors Influencing Seed Germination for Linum rigidum (Yellow Stiff Flax)

We investigated whether two techniques, cold moist stratification or application of exogenous hormones, were effective in breaking seed dormancy in Linum rigidum (yellow stiff flax), whose conditions for germination have not previously been reported. We were also interested in whether surface sterilization affects seed germination rates. In the study focused on effects of stratification, we divided seeds into six groups, three surface sterilized and stratified for zero, one or two months, and three not surface-sterilized and stratified for the same time periods. The unstratified groups were placed in replicate petri dishes directly under fluorescent lights, while the others were stratified at 4°C for appropriate durations prior to placing under lights. We monitored germination for up to two months. Seed germination rate did not significantly differ with surface-sterilization. Germination occurred slowly and sporadically in all groups; however, longer stratification duration significantly decreased germination rates. In a second study, we tested the effect of two hormones, gibberellic acid and cytokinins on germination rates on seeds not subjected to cold stratification. We found that germination occurred more quickly in the presence of gibberellic acid at two concentrations (1000 mg L⁻¹ or 100 mg L⁻¹), but was unaffected by cytokinin (215 mg L⁻¹). These results indicate that *L. rigidum* experiences physiological dormancy but cold stratification does not break dormancy.

Division of Natural Sciences and Engineering, University of South Carolina Upstate, Spartanburg, South Carolina

P194 • Hannah M. White, Amanda Gains, C. Brian Odom

An Examination of Less Toxic Substitutes for Ethidium Bromide Comparing Migration Shifts, Resolution, and Quantitation of Agarose Gel Stained DNA Fragments

Traditionally, DNA fragments in agarose gels have been resolved via staining with the intercalating dye, Ethidium Bromide. In recent years, less toxic and mutagenic alternatives to EtBR staining have become commercially available. Several of these newer alternatives were compared to EtBr to determine their suitability to substitute for this compound in both the teaching lab and in undergraduate research projects. Wingate University has completely replaced EtBr in the undergraduate teaching program. Can it also comparably replace EtBr in the undergraduate research lab as well?

Dept of Biology, Wingate University, Wingate, NC

P195 • Kunsiri Chaw Grubbs¹, Samuel J. Grubbs²

An Examination of Policies Intended to Address the Lack of Female Science Faculty

Women are an underrepresented part of the faculty in science Depts at many U.S. universities. University and national-level policies have driven efforts to improve the imbalance. This poster highlights many of the efforts to improve this inequality by presenting the stages of the policy process. The goal of this poster is to show how gender diversity in science faculties can be an effective part of the policy agenda. Through an understanding of the policy process, science Depts can better implement policies to develop more women science academics for future generations.

¹ High Point University: ² Wake Forest University

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P196 • Tracy L. Deem¹, Crystal Scott Croshaw²

Harmful Effects of Insecticide on Larval Development in *Callosobruchus maculatus*? An Inquiry-Based Lab for Immunology, Biochemistry, or Developmental Biology Classes

The American Association for the Advancement of Science (AAAS) has challenged biology educators to develop active learning strategies that ensure students understand the process of science. In this multi-week, inquiry-based laboratory exercise, students are asked to design experiments to examine a possible mechanism for insect resistance to insecticides. Recent research has suggested that resistance may be due in part to the activity of the enzyme phenoloxidase (PO). PO is the last enzyme in a multi-enzyme cascade leading to melanin deposition. Melanization is one of the defenses used by the innate immune system of insects to surround and neutralize pathogens. Students are tasked with designing experiments to detect PO activity and to determine if insecticide-induced changes in larval development correlate with PO activity. Since this laboratory is designed to last the entire semester, it gives students a better sense of the process of science.

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P197 • Halley Alberts, Rob Hopkins

Improving Spatial Thinking: A Student-Driven Approach to Teaching Spatial Statistics

Spatial analysis is a powerful and broadly applicable analytical tool that is especially useful to ecologists. However, the topic is too often under-addressed in the classroom setting. When it is taught the traditional approach may be less than effective at fostering an improvement in student spatial thinking. Typically, students follow a strict procedure of data collection and data analysis - effectively reducing the exercise to plug-and-chug. In the words of a former pupil this approach regularly leaves students knowing essentially nothing except for a formula that they have no idea how or why it works. In this paper we present a primer exercise aimed at improving student spatial thinking and their basic understanding of how spatial statistic equations provide information about spatial dispersion. The central component of this approach is to have students develop their own spatial statistic equation to quantify dispersion and compare the results of their equation with a standard statistic. In the end, by creating the equation themselves many students gain a firmer understanding of where the results came from, rather than simply getting a number that they can't relate to. Not only does this method aid in teaching a particular concept, it also requires more active learning and circumvents the tendency for students to relegate labs to strict procedure-following exercises or what we like to refer to has hands-on, brains-off.

Dept of Biology, University of Rio Grande, Rio Grande, OH

P198 • Jordan L. Hartman, Amy L. Rangel, C. Brian Odom

Mother Nature Pharmacy: A Biological Separations and Bioassay Exercise for the Non-Major Undergraduate Laboratory

To most non-majors, the vast majority of laboratory exercises make little, if any, real sense. We wanted to develop a multiple-week exercise that would engage the students with a real world example of applied biological research that involves both molecular and organismal components. During the course of this laboratory series (three laboratory periods) students will prepare an extract of the rhizomes of the common bloodroot, Sanguinaria canadensis, separate the extracted compounds with 2 and 3-dimensional paper chromatography, and finally, test the separated compounds for antimicrobial activity with a simple zone inhibition assay.

Dept of Biology, Wingate University, Wingate, NC

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P199 • Jennifer Greenwood, Lisa Krueger, Dawn Wilkins, Tom Blanchard

The Reelfoot Lake Environmental Field Station: An Emerging Research Facility With New Summer Field Course Program

Reelfoot Lake in northwest Tennessee is a shallow, nutrient-rich, soft-bottomed lake that was formed by the New Madrid Earthquakes of 1811-1812. Many unique aquatic, wetland, and terrestrial environments comprise the lake and its surroundings. The College of Engineering and Natural Sciences at the University of Tennessee at Martin operates the Reelfoot Lake Environmental Field Station (RLEFS), a year-round research and teaching facility near the shores of Reelfoot Lake in Samburg, TN. The facility hosts two laboratories/classrooms, accommodations for 22 people, basic aquatic and terrestrial field equipment, and small motor boats and canoes. RLEFS is near a wide variety of terrestrial and aquatic habitats, federal and state wildlife areas, and is in close proximity to the Mississippi River. A new summer course program was established in 2012 at RLEFS which has offered 2-3week Maymester courses (Aquatic Macroinvertebrates, Field Herpetology, and Geology of the Greater Reelfoot Lake Ecosystem) and 5-week courses during the June summer term (Freshwater Algae, Field Ornithology, and Aquatic and Wetland Plants). All courses have a day-long format designed to give students an intensive, focused field experience. RLEFS also hosts overnight field trips for courses from visiting institutions. RLEFS facilities support varied research interests, Recent research projects have included studies of sedimentation rates of the lake, diatom diversity, heron rookeries, amphibian and reptile distribution, fish diets, Barred Owl vocalizations, and crayfish parasites. We encourage anyone interested in participating in research activities, field trips, or teaching a course at RLEFS to contact the director, Tom Blanchard.

Dept of Biological Sciences, University of Tennessee at Martin, Martin, TN

P200 • Bradley R. Reynolds, Thomas P. Wilson

Lessons Learned Using Transformational Leadership and Reflective Journaling: A Case for Hands-on Herpetology

Technology has made our lives faster, better, and increasingly multidimensional. When we immerse ourselves in technology, however, we risk losing our connection to nature and a proper perspective on our place in the natural world. In an effort to combat nature deficit disorder, we integrated field work and hands-on-herpetology into our instruction of a nonlaboratory lecture course. Specifically, we evaluated the impact of transformational leadership, experiential learning, and reflective journaling on the conservation ethic of non-science majors in an introductory survey course. We used a paired t-test to compare the students' conservation ethic before and after the course. Data suggest that for the lecture-only group, their ethic scores were not statistically different when compared to their scores prior to the experience. The ethic scores for the field group were statistically different when compared to their initial scores. Our field group also displayed an increase in empathy for salamanders while the lecture-only group did not. However, an independent-samples t-test showed no significant difference in conservation ethic between the lecture-only and field groups. Further, analysis of the reflective journals indicated recurring themes, including confronting fear, recognition of life's interconnectedness, the importance of small changes and of educating others, and evidence of true empathy. Structured interviews revealed transformational leadership and experiential learning did positively impact students, while reflective journaling had a lesser impact. This study suggests that transformational leadership, experiential learning, and reflective journaling are powerful tools that educators may be able to use to positively impact student conservation ethic.

Dept of Biological and Environmental Sciences, University of Tennessee at Chattanooga, Chattanooga, TN

P201 • Suzanna L. Brauer

Adding Universal Design for Learning (UDL) to a Junior-Level Undergraduate Microbiology Course Increased Student Grades, but Not Student Ratings of the Course

The key principles in Universal Design for Learning (UDL) are to provide multiple means of 1) representation, 2) action and expression and 3) engagement (www.cast.org/udl). During the fall semester of 2013, the curriculum of a junior-level undergraduate class in microbiology was modified to integrate UDL concepts into the curriculum. Throughout the semester, students were provided more choices in homework assignments, more opportunities to research and/or present topics of interest and more opportunities to utilize hand-on models while solving problem sets. Compared to the previous semester in which the course was taught, student rating of the course stayed the same. In contrast, mean grades increased by one percentage point, median grade increased by two percentage points and the percentage of students earning an A (≥90% of the points) increased from 22% to 44% compared to the previous semester. Overall, adding assignments and activities that adhere to UDL principles resulted in a moderate improvement in course design and appeared to enhance student learning.

Dept of Biology, Appalachian State University, Boone, NC

P202 • John A. Mecham

Light Microscopy Measurements of Muscle Sarcomere Lengths in Fresh Tissue

Discovery oriented lab experiences that require critical and analytical analysis, with a minimum of sophisticated instrumentation, are important tools for advancing scientific curiosity and maturity. The goal of the lab exercise presented here is for students to gain functional anatomy knowledge together with microscopy and metric analysis skills via the measurement of skeletal muscle sarcomere lengths in fresh muscle. Following a discussion of the microanatomy and physiology of striated muscle sarcomeres, students are directed to make and observe wet mount slides at 400X of very small amounts of fresh fish, such as flounder, for the presence of A and I bands. Due to the anisotropic (A) and isotropic (I) light refraction characteristics of actin and myosin, the students will be able to see the bands clearly without any stain, as well as gain a qualitative appreciation for muscle fiber diameter and length. Next, after a discussion on how they might measure sarcomere lengths, the students calibrate their microscopes at 400X and 1000X with a stage micrometer. They then calibrate a mm ruler, based on ocular units, that will be used to measure linear sarcomeres on a printed-to-scale digital photograph of their flounder tissue. Using their raw data, they calculate sarcomere um lenoths. Results are surprisingly similar to previously reported sarcomere lengths measured with electron microscopy (EM). The students are asked to critically compare the advantages and disadvantages of their techniques with those involving EM, and to form a list of potential variables for future research.

Dept of Biological Sciences, Meredith College, Raleigh, NC

P203 • Holly Boettger-Tong¹, Vivia L. Fowler², Gareth Jones³, Brooke Bennett-Day⁴

Lessons Learned From Three Years of the Math/Science Student Preparation and Retention (SPARC) Collaborative

Retaining potential science and math majors to graduation is a challenge faced by most institutions, regardless of the size of the undergraduate student body. In 2011, Wesleyan College, a small, single-sex undergraduate liberal arts institution, began a program designed to test the hypothesis that intensive faculty advising, upperclass student peer mentoring and academic Bootcamp experiences would have a positive impact on student performance and retention in STEM fields. The participants chosen for this initiative were two small cohorts of Pell-eligible students (SPARC Scholars) from the state of Georgia intending to major in science or mathematics. An additional set of students were matched to this cohort in terms of their socioeconomic status, SAT scores and their intended majors. Comparisons of GPA and midterm deficiencies between the SPARC cohorts and

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the matched groups were made and the data indicate that SPARC scholars had a higher average GPA and fewer midterm deficiencies than the matched students. In addition, pre/post assessment of the impact of week-long summer academic Bootcamps indicated marked effects on cohort cohesiveness (Bootcamp I) and measurable improvements in student spatial reasoning skills (Bootcamp II). Self-reported data indicated that SPARC scholars viewed their Bootcamp and advising experiences favorably and that Peer Advisors had a positive impact on Scholars' academic experience. The first cohort of SPARC scholars are Juniors and retention in the major stands at approximately 60%, which exceeds the national (and Wesleyan's historical) average. Based in part on data obtained from the SPARC program, Wesleyan has recently instituted a peer mentoring initiative aimed specifically at first year students enrolled in Introductory Biology (BIO 110) entitled PASS (Peer Assisted Student Support). Preliminary data from this initiative suggests a positive correlation between PASS session attendance and student achievement in this introductory majors course.

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P204 • Hart, S.K., Mikhailova, E.A., Post, C.J., McMillan, P.D., and S.K. Cox

Weather extremes and phenological changes of the shores of Lake Issagueena

Climate change is increasing the occurrence of extreme weather and it can impact plant phenology. The objectives of this study were to document the effects of drought and heavy rain on the phenology (flowering) of plants around Lake Issagueena, SC. Historical and current phenological studies of Lake Issaqueena were recorded by herbarium collections, temporal digital photographs taken with GPS-enabled camera (stored in Picasa 3 web albums and project website) on a monthly basis. The species of the Verbenaceae family bloomed later than they had in 1970-71. The species of the Acanthaceae, Asteraceae, Aristolichiaceae, Asclepiadaceae, Aceraceae, Berberidaceae, Betulaceae. Campanulaceae. Caprifoliaceae. Caryophyllacea, Celastraceae Convulvulaceae, Cornaceae, Ericaceae, Euphorbiaceae, Fagaceae, Gentianaceae, Grossulariaceae. Hippocastanaceae. Iridaceae. Laminaceae. Liliaceae. Nymphaeaceae, Orobanchaceae, Polygonaceae, Pyrolaceae, Melastomataceae, Ranunculaceae, Rhamnaceae, Rosaceae, Saxifragaceae, Scrophulariaceae, Solanaceae, Styracaceae, Symplocaceae, and Violaceae bloomed earlier than they had in 1970-71. There were species within the Fabaceae and Rubiaceae families that bloomed earlier and later than the observed blooming times in 1970-71. There seems to be a phenological shift in blooming times with species blooming later in the 2012 year of drought and species blooming earlier in the 2013 year of heavy precipitation. It appears the weather extremes influence the plant phenology around Lake Issaqueena despite the temperature buffering impact of the lake.

School of Agricultural, Forest, and Environmental Sciences, Clemson University, Clemson, SC

P205 · Yun, H., Mikhailova, E.A., and C.J. Post. 2014

Adaptation of Soil Judging to Northeast China

Soil Judging teaches students important skills for field identification of soil types, their properties, and interpretations for use. The adaptation of Soil Judging in China can be beneficial to students as well as government agencies and private sector. The objective of this study was to adapt Soil Judging to northeast region of China by a graduate student from China, who was trained using an undergraduate course in Soil Judging and a regional Soil Judging competition. Unlike the U.S., China has 14 soil orders with six soil orders somewhat similar to the ones found in the Southeast region of the U.S. A Southeastern Region Soil Judging Handbook was used for newly developed teaching materials for Northeast of China (including tables of soil physical and chemical properties, topographic maps, and scorecards). These new teaching materials can significantly

improve soil education in China and mitigate problems associated with land use management.

School of Agricultural, Forest, and Environmental Sciences, Clemson University, Clemson, SC

P206 • Pilgrim, C.M.1, Mikhailova, E.A.1, Post, C.J.1, Hains, J.J.2, and S.K. Cox1

Land use changes in the Lake Issaqueena watershed, South Carolina

Over the last 75 years, the Lake Issaqueena watershed has experienced a drastic shift in land practices. This study was conducted to examine the changes in land use and land cover (LULC) that have occurred. Aerial photography of the watershed (1951, 1956, 1968, 1977, 1989, 1999, 2005, 2006 and 2009) was analyzed and classified using the geographic information system (GIS) software, ArcGIS. Seven land classes were defined: evergreen, deciduous, bare ground, pasture/grassland, cultivated and residential/other developments. From 1951-2009, the watershed experienced an increase of tree cover and bare ground (17.4% evergreen, 62.3% deciduous, 9.8% bare ground) and a decrease of pasture/grassland and cultivated (42.6% pasture/grassland and 57.1% cultivated). From 2005 to 2009, there was increase of 21.5% in residential/other developments due to a national housing boom. Prior to 1938, the area consisted of single-crop cotton farms, but after 1938 the farms were abandoned, leaving large areas with eroded soil. Starting in 1938, Clemson reforested almost 30% of the watershed, while the remainder was privately owned. Currently, 3/4 of the watershed is forestland, with a limited extent of small farms and residential developments.

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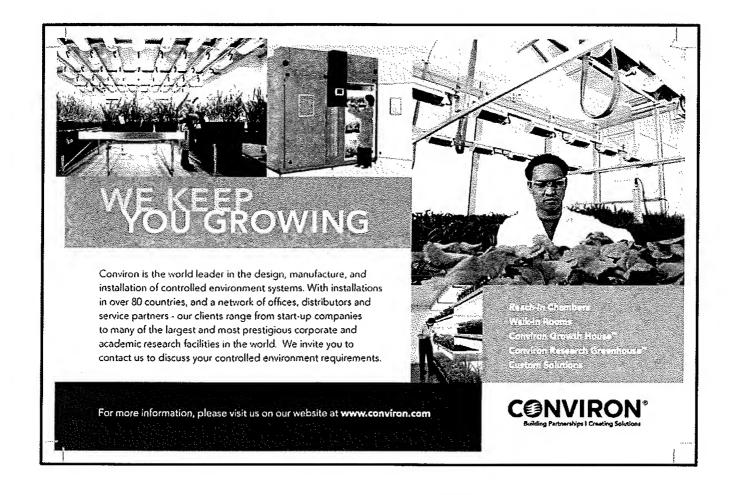
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FIFTY-SEVENTH ANNUAL MEETING BETA BETA BETA SOUTHEASTERN REGION

DISTRICTS 1 and 2

MEETING JOINTLY WITH THE SEVENTY-FIFTH ANNUAL MEETING OF THE ASSOCIATION OF SOUTHEASTERN BIOLOGISTS

co-hosted by

Converse College, Spartanburg Community College, Spartanburg Methodist College, University of South Carolina Upstate, Wofford College



Host Chapter: Tau Gamma, East Carolina University, Greenville, NC

April 2-5, 2014

Spartanburg, South Carolina

DISTRICT I BROOKS AWARD SESSION CEDAR SPRING

Deal, Michelle. Sigma Psi. Florida Institute of Technology. Reef development in Pacific Panamá: implications of millennial-scale changes in bioerosion.

Rising sea temperatures, ocean acidification, diseases, and nutrient input all limit accretion rates of coral-reef frameworks. When corals are under significant stress from their environment, they are more susceptible to bioerison by reef-dwelling organisms. In order to measure changes in the intensity of bioerosion within the past ~5,500 years, we estimated the percent area of bioerosion within cross-sectional images of individual *Pocillopora* spp. corals from Contadora Island, off the Pacific coast of Panamá. Bioerosion was variable through time, but was especially high just before and after a regional interruption in reef accretion from ~4000–1500 years ago. Previous research indicates that increased variability of El Niño Southern Oscillations was the driver of historic reef collapse in Pacific Panamá. The increase of bioerosion surrounding the period of reef collapse is consistent with the prediction that reefs may shift to a net erosional state as environmental perturbations increase. A better understanding of when and why the intensity of bioerosion changed in the past could be important in making predictions about reef development in a future now defined by the impacts of global climate change.

*Padgett, Jessica. Kappa Kappa. Georgia Regents University. Investigation of a Rare, Endangered Plant Species Recently Discovered Only on Serpentine in Georgia.

Pediomelum piedmontanum, "Dixie Mt. Breadroot," exists in the lower piedmont of Georgia and South Carolina. It features only one known serpentine population in Georgia. Serpentine [Mg₃Si₂O₅] soils are derived from ultramafic rock and typically contain high concentrations of heavy metal. We hypothesize that local adaptations to metals present in the substrate may provide insight into its limited distribution. Previously, our lab has discovered that the serpentine population is tolerant up to 100µM Zn. Based on this finding, we decided to determine the level of Zn accumulation in the leaves of field collected and lab-raised plants, The level of Zn accumulation from field and experimental leaf samples was determined using the zincon colorimetric test. The level of Zn accumulation in leaves from the field was significantly lower than other legume species (p<0.05). Zn accumulation was greater in the roots than in the shoots in plants propagated with Zn enrichment (p<0.05). These results are consistent with the fact that this species has a large taproot. In addition to these findings, lab-raised plants demonstrated symptoms of Mg deficiency. Thus, Mg tolerance will be the focus of future study. This population may require an unusual concentration of Mg in order to reach maturity. *second place winner of the District I Brooks award

*Whatley, Vivian; Stephen Baron. Nu Epsilon. Bridgewater College. Determination of the Genomic Location of the *tetB* Gene of *Escherichia coli* Isolated from Black's Run.

Antibiotic resistance has emerged recently as a major problem on a worldwide scale. Diseases caused by pathogens are becoming more difficult to treat due to many pathogens having resistances to one or more antibiotic. The majority of resistances are acquired via horizontal gene transfer which is the transfer of genes between two different species. The *tetB* gene encodes part of a tetracycline efflux pump which confers tetracycline resistance. Previously, we isolated a tetracycline-resistant strain of *Escherichia coli* from an industrial watershed known as Black's Run. We detected the *tetB* gene in this strain, using a colony polymerase chain reaction method (PCR). The purpose of this study is to determine whether *tetB* in this strain is located on a plasmid or on the

chromosome. First, chromosomal DNA and plasmid DNA will be isolated using commercial kits, further purified by agarose gel electrophoresis, and subjected to PCR to detect *tetB*. If the gene is located on a plasmid, it will be removed by plasmid curing, which will be assessed by colony PCR and conversion of the strain to tetracycline sensitivity. *third place winner of the District I Brooks award

*Stokes, Faith. Beta Chi Nu. Dalton State College. Venom from Local Snake Species: A Potential Source of Antibacterial Treatment.

The recent rise in deaths and serious illness from antibiotic resistant bacterial strains is a major concern for medical researchers, health professionals and government agencies. The demand for new antibacterial agents is increasing and their development must occur alongside the evolution of pathogens. Snake venom has been identified as a possible source of antibacterial treatment. However, the make-up of venom is not uniform across species since each snake must have a unique biological recipe to combat the environment in which it lives and the prey it eats. We investigated the antibacterial activity of venom from five southeastern snake species against three potentially pathogenic bacterial strains that snakes and humans local to the area could encounter. Four previously untested venoms, The Northern Copperhead (Agkistrodon contortrix mokasen), Southern Copperhead (A. c. contortrix), Water Moccasin (A. piscivorus conanti), and Timber Rattlesnake (Crotalus horridus), along with the Eastern Diamondback Rattlesnake (C. adamanteus) were tested for antibacterial activity against Staphylococcus aureus. S. epidermidis and Aeromonas hydrophila, the latter of which is a novel bacterial strain to venom studies. Whole venom yielded zones of inhibition by disk diffusion, demonstrating effective antibacterial activity against the bacterial strains. *first place winner of the District I Brooks award

Dixon, Eryn and Tracy Deem. Nu Upsilon. Bridgewater College. Detection of mCRAMP/self-DNA complexes on murine dendritic cell MHC-II molecules: a new animal model for autoimmunity?

Recent evidence in human studies involving autoimmune diseases have shown antimicrobial peptides complex with self-DNA protecting the DNA from degradation. These complexes are taken up by immune cells resulting in their activation to self-DNA. Studies to determine if a similar mechanism occurs in mice have not been addressed. If such a mechanism exists, therapeutic interventions for autoimmune diseases would be easier to study. To address this, we collected peripheral blood mononuclear cells and lymph nodes leukocytes and stimulated them with the antimicrobial peptide mCRAMP, mouse or bacteria DNA, or mCRAMP complexed with mouse or bacteria DNA. MHC II molecules were immunoprecipitated, ran on an SDS-PAGE gel, and transferred to a membrane. Western blotting was performed to determine if mCRAMP was associated with MHC II. which would suggest that these complexes are being presented on the surface of antigen presenting cells. Our studies showed that mCRAMP was associated with MHC II in cells stimulated with mCRAMP alone or bacteria DNA complexed with mCRAMP. However, mCRAMP was not detected when cells were treated with mCRAMP complexed with mouse DNA, suggesting that mCRAMP may facilitate leukocyte activation during a bacterial infection but may not play a role in autoimmunity as seen in humans.

Brooks, Shelby. Psi Rho. University of North Georgia. The effect of methamphetamine and amphetamine on the activity of matrix metalloproteinase-2 and 9 in BV2 microglia cells.

Methamphetamine (METH) and amphetamine (AMPH) are psychostimulants that are indirect agonists resulting in excess dopamine release within the brain leading to druginduced neurodegeneration. Microglia cells respond to this neural damage and release matrix metalloproteinase (MMPs) that play an important role in tissue remodeling and potentially a breakdown of the blood brain barrier. Since MMP-2 and 9 enzyme activity can be measured by gelatin zymography, we stimulated a microglia cell line, BV2, exposed to different concentrations of lipopolysaccharide (LPS), to determine the maximum activity of MMP-2 and 9 under stimulatory conditions. This will model microglia exposure to a neurodegenerative environment. The concentration of LPS with the most activity will then be used in conjunction with a dilution series of METH and AMPH. The MMP activity levels from those treated cells will be assessed through gelatin zymographic techniques. Due to tissue damage and BBB remodeling that occurs after abusing psychostimulants, we hypothesize that the activity of MMP-2 and 9 will be up regulated when exposed to METH and AMPH in the presence of LPS stimulation. The upregulation of MMP activity may be linked to the neurodegeneration that occurs in the brain due to misuse of psychostimulants.

Dunbar, Matt. Sigma Phi. Guilford College. Bioremediation of oil in the Arctic sea by Indigenous Bacteria.

The cold climate of the Arctic sea and its natural bacterial populations has not been studied extensively, for the potential to degrade hydrocarbons. To determine this potential I examined microcosms containing seawater and sea ice taken from the high Arctic and incubated under ambient conditions in the presence of crude oil. The microcosms were incubated at -1°C for 15 days, with shaking. Chemical analysis was performed on the microcosms to determine the removal efficiency of the hydrocarbons, and the microcosms were filtered at two times over 15 days to collect the microorganisms that had developed during the incubation. Total DNA was extracted from the filters and 16S rRNA gene fragments were amplified and sequenced to determine the taxonomy of the bacteria present and metagenomic sequencing was performed to identify some of the functional genes involved in hydrocarbon degradation. The results showed a significant increase in known bacterial hydrocarbon degraders in seawater containing oil compared to the controls and the chemical data corroborated this shift in bacterial diversity. Sea ice did not show significant changes between controls and oiled samples. The results suggest that seawater does contain an active hydrocarbon degrading bacterial population that responded rapidly to the presence of oil.

*Worthy, Kelsey², Zhong Fang¹, Patricia C. Dos Santos. Sigma Theta. ¹Department of Chemistry, Wake Forest University, ²Guilford College. The Role of Cysteine Desulfurase (NifS) of *Bacillus subtilis* in the Assembly of the [4Fe-4S] Cluster of Quinolinate Synthase (NadA).

Nicotinamide adenine dinucleotide (NAD) plays an essential role in biosynthetic pathways of all living organisms. The biosynthetic scheme of NAD can be achieved through two main pathways: *de novo* or salvage biosynthetic pathways. In the *de novo* biosynthetic pathway in most bacteria, quinolinic acid is an important precursor, which is converted from L-aspartate by a two-step reaction catalyzed by L-aspartate oxidase (NadB) and quinolinate synthase (NadA) respectively. Previous work in *B. subtilis* has shown that deletion of cysteine desulfurase *nifS* gene, which is upstream of NadA and NadB, caused a nicotinic acid auxotrophic phenotype. Later research revealed that NadA requires a Fe-S cluster cofactor to perform its functionality in the nicotinic biosynthesis pathway. Since sulfur mobilization by cysteine desulfurase is the first step of Fe-S biosynthesis, we hypothesize that NifS is essential to the production of the 4Fe-4S cluster in NadA. Initial

experiments devoted towards the characterization of NifS showed an optimum pH of 8.0 with an associated pKa of 7.36 and a $K_{\rm m}$ for cysteine of 20 μM . Moreover, in this study investigated the kinetic profile of alanine formation by NifS when in the presence of components of the NAD pathway, NadA and/or NadB. Later studies focused on the reconstitution rate of Fe-S cluster on NadA under various conditions to explore the involvement of NifS on the direct assembly of Fe-S cluster onto the quinolinate synthase NadA.

*honorable mention winner of the District I Brooks award

Tadros, Sandra and Jennifer Cannon. Kappa Kappa. Georgia Regents University. Perfluorooctanoic acid induced reduction in steroidogenesis in mLTC-1 cells: is it due to downregulation of the luteinizing hormone receptor?

Perfluorooctanoic acid (PFOA) is a perfluorinated chemical found in many industrial and consumer products that is gaining notoriety as an environmental contaminant and endocrine disruptor. Previous studies demonstrated that 24 h treatment of mouse leydig tumor (mLTC-1) cells with 100µM PFOA reduced human chorionic gonadotropin (hCG) stimulated progesterone (P4) synthesis by greater than 16-fold compared to hCGstimulated control cells. This was not caused by a significant decline in cell viability. To rule out the possibility that the decrease in steroidogenesis was due to downregulation of the luteinizing hormone receptor (LHR), two experimental approaches were taken. One approach involves stimulating cells with forskolin as opposed to hCG. Forskolin bypasses LHR, directly stimulating adenylyl cyclase. Preliminary data demonstrate a marked decline in P4 production in PFOA-treated cells, even when stimulated with forskolin. The second approach involves looking directly at the expression of LHR. Primers for both LHR and the housekeeping gene glyceraldehyde 3-phosphate dehydrogenase (GAPDH) have been ordered and are currently being optimized for quantitative PCR. Based on the experiments with forskolin, it is not anticipated that a decline in LHR expression will be observed, as bypassing the receptor still results in a reduction in steroidogenesis in PFOA-treated cells.

DISTRICT I BROOKS AWARD SESSION WISTERIA ROOM

Hayes, Robin; Amanda Helton, Chris Tavares, Dr. Ryan Shanks, Dr. Steven Lloyd. Psi Rho. University of North Georgia. The Effects of Adolescent Methylphenidate Exposure on the Expression of Δ FosB in the Prefrontal Cortex and Striatum.

Methylphenidate (MPD), the active ingredient in Ritalin®, is a psychostimulant whose main mechanism of action is to block dopamine transporters. MPD abuse is on the rise amongst adolescents given its euphoric and nootropic effects. Chronic drug abuse is known to have lasting effects on neural plasticity. Multiple studies with other stimulants indicate accumulation of the transcription factor $\Delta FosB$ in areas of the brain associated with reward and compulsivity, leading to speculations on the protein's role in drug addiction and relapse. Previous behavioral research in our lab demonstrated MPDinduced behavioral changes in both prenatal and adolescent exposure paradigms. In this study, we investigated the same MPD-exposure dosing paradigms. The prefrontal cortex and striatum for each mouse were micro-dissected, homogenized, and total RNA was isolated. Drug induced changes in fosB expression will be measured using qPCR against experimental and internal controls (i.e., 18S). We hypothesize that there will be increased expression of the fosB gene in mice treated with methylphenidate compared to those treated with saline in both exposure paradigms. Through an understanding of the physical mechanisms by which chronic drug abuse alters the brain, we can seek therapeutic methods that will target and treat the MPD-induced damage.

*Otano Vilanova, Maria V.; Esmeralda Gonzalez; Benjamin Darnell; Amelia Harvey; Steven A. Lloyd; Ryan A. Shanks. Psi Rho Chapter. University of North Georgia. The effect of low dose adolescent amphetamine on adult cross-sensitization to methamphetamine.

The use of ADHD medicines has increased due to overprescription and trending recreational use, especially in adolescents. Repeated exposure to amphetamine psychostimulants produces neural and behavioral adaptations that contribute to addictive behavior. Adolescence is a time of physical, mental, and emotional development. This study assessed long-term neural changes in adulthood, expressed as behavioral crosssensitization in an open field chamber, caused by exposure to amphetamines during adolescence. C57Bl/6J mice were treated with low doses (0.01, 0.1, or 1 mg/kg) of amphetamines for 10 days during a period of early adolescence (P22-P31), followed by a washout period until adulthood (P90) and challenged with a sub-acute dose of methamphetamine (METH). Overall results indicate that adolescent animals injected with both 1.0 and 0.1mg/kg of amphetamine show increased locomotor activity following a METH challenge. However, activity in the 0.01 mg/kg group was not different from controls, suggesting this low dosage does not produce persistent long-term changes in the brain. Our results reflect a human model of early teenagers taking prescription amphetamines to treat ADHD, but who do not actually have the disorder, are at risk to sensitization to methamphetamine as adults even if they are using a very low therapeutic

*honorable mention winner of the District I Brooks award

*Moore, Charles. A Tale of Two Gardens: Comparing the Aquatic Ecosystems of Two Public Gardens, Greensboro, NC.

The assessment of aquatic environments is essential when evaluating the overall condition of the surrounding terrestrial ecosystem. In particular, the macroinvertebrates living in these waterbodies can be useful bioindicators of ecosystem integrity. The Bicentennial Garden and the Bog Garden are located in an urbanized floodplain in Greensboro, NC, along a stream that feeds into the local drinking water supply. We compared the aquatic ecosystems of both gardens using data collected between September 2013 and February 2014. The physical habitats were assessed using the Environmental Protection Agency's Rapid Bioassessment Protocols (RBP) and nine water quality parameters were evaluated. Macroinvertebrate populations were sampled and artificial leaf packs were created to compare macroinvertebrate colonization of different plant species found in each garden. Physical evaluations placed both gardens in the low suboptimal range. Average water quality measurements for both gardens fell within state standards, but the Bicentennial Garden scored significantly better in two key parameters that impact macroinvertebrates—dissolved oxygen and turbidity. Preliminary results indicate the Bicentennial Garden has a greater diversity of macroinvertebrate families. This suggests that the sedimentation and lower oxygen levels in the Bog Garden may be adversely impacting the variety of macroinvertebrate habitats available, resulting in lower family richness.

*third place winner of the District I Brooks award

Bement, Brian. Sigma Psi. Florida Institute of Technology. Ontogeny of temperature-induced modulation in the feeding kinematics of the invasive lionfish, *Pterois volitans*.

The ability of an exotic species to establish invasive populations depends on its possession of the physiological and behavioral traits appropriate to survive in an invaded ecosystem. It is known that temperature influences organismal performance, especially in

poikilotherms. With the continuing spread of the invasive Indo-Pacific lionfish (*Pterois volitans*) poleward into cooler waters, it is imperative to determine the ability of lionfish to perform tasks at different temperatures. Although it is known that the capacity of a species to thrive is dependent on its ability to effectively capture prey, little is known about the integrated effects of body size and temperature on feeding performance in this invasive species. Lionfish feeding events were filmed using high-speed video. A frame-by-frame analysis of gape, hyoid depression, cranial rotation, and jaw displacement was conducted and compared among size-classes and temperature regime. Effect of temperature on performance throughout expansive and compressive phases of feeding were quantified by calculating area under the curve, average distance velocity, average angular velocity, and Q_{10} temperature coefficients for individual profiles. By modeling temperature effects on feeding performance in different sizes of lionfish, we are able to gain insight into the magnitude and variation of temperature effects on prey capture performance.

*Vincent, Jessica. Psi Rho. University of North Georgia. Barrier-to-Autointegration Factor-Like (BAF-L) Interacts with Histones.

Barrier-to-Autointegration Factor (BAF) is a conserved DNA binding protein with cellular roles in nuclear assembly, regulation of chromatin structure, and gene expression. The regulation of chromatin structure by BAF is most likely mediated through its interactions with DNA and histones. BAF is regulated through phosphorylation, but there are other potential modifications of BAF that remain unknown. Barrier-to-Autointegration Factor-Like (BAF-L) is a protein that is 40% identical and 53% similar to BAF at the amino acid level. Recombinant BAF-L can form stable homodimers and can heterodimerize with BAF in vitro and in vivo. Although BAF-L does not significantly bind to DNA and other partners of BAF, it can interact with BAF in the presence of DNA. These distinct biochemical characteristics of BAF-L suggest that it might regulate BAF function through formation of BAF/BAF-L dimers. We hypothesize that binding of BAF-L may help regulate BAF interactions with histones and DNA. Preliminary data for our research group suggests that BAF-L can, like BAF, bind to histones H1 and H3. We will confirm this preliminary finding and extend it by testing BAF-L binding to histones through several protein-protein interaction assays.

*first place winner of the District I Brooks award

Steinmann, Constance, Sydney Nazerian, Ryan A. Shanks, and Steven A. Lloyd. Psi Rho. University of North Georgia. Methamphetamine-induced activity of matrix metalloproteinases in the striatum and prefrontal cortex of C57BI/6J.

Matrix metalloproteinases (MMPs) are enzymes active in the pericellular environment. Their activation and regulation are important in maintaining tissue homeostasis and synaptic physiology as they contribute to normal physiological remodeling in the brain. Their role in neuronal plasticity is of particular interest in the context of addiction as they are thought to contribute to the development of behavioral sensitization to drugs of abuse such as methamphetamine (METH). In addition, MMP upregulation is linked to long-term change in neural physiology. Methamphetamine-induced behavioral sensitization as well as METH-induced dopamine release are attenuated in MMP-deficient mice. Methamphetamine and similar psychostimulants alter the central nervous system by increasing the amount of dopamine released in pathways in the brain through redistribution of dopamine synaptic vesicles to the cytosol and promotion of reverse transport. Toxic effects of METH are thought to depend on the drug's similarity to dopamine (DA), which allows METH to enter DA axons and release DA from the synaptic vesicles. Here, we investigate the effect of high-dosage METH treatment on MMP activity in the striatum and prefrontal cortex of adult C57BI/6J mice given their role in reward,

addiction, behavioral sensitization, and associated neural remodeling. A gelatin zymography method is used to measure the activity of the MMPs. MMP activity change in these areas raises an important concern about long-term effects of psychostimulant abuse to the brain. We hypothesize that increased activity of MMPs in the brain contributes to many of the synaptic changes that result in the formation of addiction pathways and may possibly lead to the "leakiness" of the blood brain barrier as a result of METH abuse. Understanding the role of increased MMP activity will further our knowledge of how drug abuse changes the brain.

*Draghetti, Mary. Sigma Psi. Florida Institute of Technology. Spawning sites and larval distributions of ladyfish, Elops saurus, in the Gulf of Mexico.

Ladyfish, Elops saurus, is an important sportfish species within the superorder Elopomorpha which contains tarpon, bonefish and eels. A primary synapomorphy of the superorder is the unusual leptocephalus larval stage. Sharing unique larval morphologies with commercially valuable fishes, ladyfish serve as an important model species. Although ladyfish are common throughout the coastal waters of the Southeastern United States and Gulf of Mexico, little is known about their spawning biology or larval dispersal. The SEAMAP program has conducted surveys of larval fish distributions in the Gulf of Mexico for several decades, but ladyfish leptocephali have never been analyzed to determine their temporal and spatial patterns of spawning and larval distributions. For this study. leptocephali in SEAMAP samples were collected through SEAMAP, examined to confirm identification as E. saurus, measured to the nearest millimeter, (SL), and assigned to the appropriate larval stage. The dispersal locations of the earliest developmental stages of E. saurus provides critical knowledge of spawning locations and distributions of larger larvae, reflect transport pathways to coastal nursery habitats, and larval dispersal of E. saurus and other valuable Elopomorphs. This information on spawning sites, larval distributions and transport pathways will provide valuable information to fisheries biologists, ecologists, and fisheries managers working in coastal ecosystems.

*second place winner of the District I Brooks award

Veenis, Andrew. Nu Upsilon. Bridgewater College. Construction of Reporter Plasmids for Studying the *phaZ* Promoter Region of *Streptomyces sp. 5A*.

Polyhydroxbutyrate (PHB) is a plastic-like polymer produced by certain bacteria which can be used as a biodegradable substitute for petroleum-based plastics. The soil bacterium, *Streptomyces sp. 5A*, produces a PHB depolymerase during growth in the presence of PHB or 3-hydroxybutyrate (3HB), but not during growth on glucose, suggesting that transcription of the PHB depolymerase gene (*phaZ*) is regulated. The long term goal of our research is to determine the molecular mechanism for this regulation. Our lab has previously cloned and sequenced 169 base pairs of DNA upstream from the coding region of *phaz*. This upstream sequence contains the putative promoter region with three sequences that may play a role in transcriptional regulation of the gene. The polymerase chain reaction was used to selectively delete these sequences. The altered *phaZ* promoter regions were then inserted upstream from a promoter-less lux operon in the reporter plasmid pRT Flip. Some of the resulting constructs were then introduced into *Streptomyces coelicolor*, a model streptomcyete. Activity of the altered *phaZ* promoter region will be assessed by measuring bioluminescence expressed during growth on various media.

DISTRICT II BROOKS AWARD SESSION KING MOUNTAIN

*Haley E. Ellison, Belmont University, Mu Theta, District II, Effect of starvation on heart physiology of *Anopheles gambiae*, Oral

Haley E. Ellison ^{1,2}, C. Steven Murphree ², and Julian F. Hillyer. ¹Department of Biological Sciences, Vanderbilt University² Department of Biology, Mu Theta Chapter, Belmont University. Effect of starvation on heart physiology of *Anopheles gambiae*.

The insect circulatory system propels hemolymph and immune cells throughout the hemocoel. The primary organ responsible for driving hemolymph flow is the dorsal vessel, comprised of the thoracic aorta and the abdominal heart. Wave-like contractions of the heart propagate in both anterograde and retrograde directions with anterograde contractions predominating. The objective of the study was to use intravital video imaging and biochemical assays to evaluate the effect of starvation on the heart of the mosquito, Anopheles gambiae. Results show that mosquito heart rates decrease by 24 hours of starvation in comparison to water fed and sucrose fed mosquitoes. Furthermore, starvation decreases the proportion of contractions and time spent propagating in the anterograde direction, but does not affect the frequency of heartbeat directional reversals. Quantitative comparison of protein, carbohydrate, and lipid levels for indidividual mosquitoes was also completed. Starvation had no effect on protein content; however, carbohydrate and lipid levels decreased in water fed and starved mosquitoes.

*honorable mention winner of the District II Brooks award

Hernandez, Rosmely. Beta Zeta. University of North Alabama. The Effectiveness of Monotherapy versus Combination Therapy on Clinically Isolated Sputum Samples.

Opportunistic pathogens are a primary concern in medical facilities. Cases of nosocomial infections caused by *Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Klebsiella pneumoniae*, and other bacteria are diagnosed every day. The development rate of nosocomial infections is 7% (developed countries) to 10% (developing countries). These infections are transmitted through direct contact from the hospital staff, inadequately sterilized instruments, aerosol droplets from other ill patients, mechanical ventilators, or even the food or water provided at hospitals. In this study, sputum samples were obtained from different medical facilities in northwest Alabama. Isolates were identified using the Biolog system and tested for antibiotic sensitivity to combination therapy and monotherapy using the Kirby Bauer method. To date, 28 isolates have been collected. It is hypothesized that antibiotic combination therapy will be more successful in the inhibition of bacteria found in sputum samples than monotherapy. Data from this research will be shared with the local biological and medical community.

*Whitley, Scott W. Mu Omicron. Columbus State University. Oral. DNA Barcoding of Grasshopper Frass to Determine Diet.

DNA barcoding is a molecular technique that uses diverse gene regions to distinguish even closely related species. In plants rbcL, a chloroplast gene region, is frequently used in barcoding. In a previous project, plant species from prairies in Mississippi and Alabama had the sequences of their rbcL gene regions determined, creating a "barcode library." In this project, I am barcoding plant material from the frass (or feces) of grasshoppers to determine their diets. Frass was collected from a range of grasshopper species on a prairie site in Mississippi. DNA was extracted from the frass using standard protocols for working with plants and then amplified using PCR. DNA samples were sent to a private company for sequencing. Contigs were then built from the sequences and edited. In a

preliminary assessment for three samples, I was able to confidently identify the plant material in the frass by comparing the sequences to the barcode library. DNA has been successfully extracted from about 67% of the samples so far. The project has demonstrated the utility of using barcodes to determine the diet of grasshoppers from their frass.

*first place winner of the District II Brooks award

Reese, J. Court and John H. Niedzwiecki. Mu Theta. Belmont University. Comparing a Nuclear Gene Genealogy with a Mitochondrial Genealogy in *Ambystoma barbouri*, the Streamside Salamander.

A published mitochondrial genealogy of *Ambystoma barbouri*, populations, revealed three distinct clades following distinct geographic lines. One basal clade contained disjunct populations in Tennessee and while the all the other populations fell perfectly into two mutually monophyletic groups north and south of the Kentucky River. Due to chance or peculiarities of a particular marker, genealogies based on a single may not fully reflect the evolutionary history of a population. Therefore, we used a nuclear marker to examine a subset of those populations in order to compare a gene tree generated from a nuclear loci to the mitochondrial data. DNA samples were purified and extended using then E21C6 primer pair. Sequenced samples were edited, aligned and cladistic analysis based on parsimony was performed. The resulting tree was compared to the existing tree. We found that, While not highly resolved, the most parsimonious tree based our data does not conflict previous published mitochondrial data.

Lane, Haley. Mu Omicron. Columbus State University. Effects of Central Pivot Irrigation on Freshwater Mussel Survivorship.

Central pivot irrigation of agricultural crops depletes aquifers faster than they regenerate. Removing water at such a rapid rate limits the quantity and consistency of water supplied to aboveground streams and creeks. Flow-rate disruptions can negatively impact the many stream-dwelling species that require consistent flow to survive including freshwater mussels. We compared stream discharge of Spring Creek, located in the coastal plain region of South Georgia before and after the installation of central pivot irrigation (1970) using time series analysis that controlled for local rainfall effects on discharge. We determined that discharge (m³/s) decreased 6.5% after central pivot irrigation began in 1970. The only time in the 74 year time series that Spring Creek did not flow was after central pivot irrigation began. In future work, I will test the response of freshwater mussels to simulated drought conditions using a factorial experiment to consider drought effects on mussel survivorship.

*Harrell, Jonathan. Mu Omicron. Columbus State University. Effect of NGF on myocardium regeneration following cryoinjury in zebrafish.

Heart disease is the leading cause of death among adults in the United States. Following an injury to the myocardium as the result of infarction or disease, humans are virtually unable to regenerate myocardium because of their low rate of cardiomyocyte replacement. Zebrafish (Danio rerio) are able to regenerate large portions of their myocardium quickly and without the formation of scar tissue. Previous studies have shown that nerve growth factor (NGF) stimulates cardiomyocyte proliferation in zebrafish larvae. In this study the effect of NGF on the rate of myocardium regeneration following a simulated myocardial infarction was examined. Approximately twenty percent of the zebrafish ventricle was destroyed with a cryoprobe, leaving the collagen matrix intact. Experimental groups were exposed to NGF at levels of 25ng, 50ng, 100ng and 500ng via direct venous injection. Zebrafish hearts were

collected, fixed, and stained at five time intervals in the space of four weeks. Zebrafish hearts will be analyzed and the rate of regeneration will be determined. It is hypothesized that increased levels of NGF will stimulate cardiomyocyte proliferation in adult zebrafish and accelerate myocardium regeneration.

*second place winner of the District II Brooks award

*Tran, Mai. Mu Epsilon. Troy University. Risk Assessment of Microbial Pathogens in Tarfilled Shells on Alabama Beach and Freshwater Tarballs.

Tarballs are remnants of petroleum found on the shoreline after an oil spill or oil seep. They are considered a contaminant to the environment and much research has focused on the potential of the hydrocarbonoclastic microbes present in them. The research by Tao et al. in 2010 was the first study to reveal that marine tarballs could pose a hazard to human health. In their research, tarball samples collected on the Gulf of Mexico beaches were found to contain the pathogen Vibrio vulnificus at 10² to 10³ times higher than the amount normally observed in marine environments. This study proposes to investigate tarballs incubated in freshwater and tar-filled shells collected on the Gulf of Mexico to validate the hypothesis that freshwater tarballs and tarshells also contain a high accumulation of pathogens like marine tarballs. As of present, bacterial DNA fragments extracted from the tarball samples have been separated using PCR-DGGE techniques and the DGGE bands of Interested have been separated and incubated. The amplified DNA fragments from these bands will be sequenced and analyzed using BLAST and MEGA 5 in order to identify the bacterial groups present.

*third place winner of the District II Brooks award

Morse, Kari & Darlene Panvini. Mu Theta. Belmont University. Comparison of Earthworm Abundance, Diversity, and Maturity Under Exotic and Native Plants at Shelby Bottoms Greenway and Nature Park, Nashville, TN.

Exotic plants can alter native plant community and earthworm dynamics. Little is known about the distribution of reproductive and non-reproductive earthworms among different plant types, specifically at Shelby Bottoms Greenway and Nature Park. It was expected that exotic plant sites would have more exotic earthworms, the occurrence of exotic worms would correlate to soil pH, and the ratio of reproductive and non-reproductive earthworms would vary among plant type and over time. Earthworm sampling; using a mustard vermifuge, occurred over 8 weeks in exotic and native plant plots. Number of earthworm species and individuals, and maturity, were recorded. Among the 1054 worms collected, 8 genera and 15 species were represented. Exotic earthworms dominated all plots, regardless of plant type, though significant pH differences were observed among plant type. The distribution of worm species varied among plant types, as did the ratio of reproductive and non-reproductive worms. Characterizing the demographics and distribution of earthworms, relative to exotic plants, is a first step towards understanding the impact of exotic species in an ecological community.

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DISTRICT I JOHNSON AWARD SESSION – POSTERS HERITAGE BALLROOM

Dehnart, Lauren M. Isolation and Identification of Bacteria Surviving in the Presence of the Long-term Antimicrobial Protect 'N Shield.

This is a continuation of last year's study of the efficacy of Protect 'N Shield on collegiate wrestling mats. There are two elements to this study; the first part served to monitor the colony forming units (CFUs) surviving on the wrestling mats throughout the year to validate last year's study. We continued to sample the mats treated with Protect 'N Shield and the untreated mats both before and after mopping with Maxima 135, in an effort to monitor growth trends throughout the semester to test our previous conclusion that Protect 'N Shield should be applied twice a semester at minimum. The second part was investigative; bacteria surviving in the presence of Protect 'N Shield were isolated, identified, and tested for antimicrobial resistance. We selected colonies that visually resembled Staphylococcus species, and then performed biochemical tests to confirm the identity of the isolates. After identification, we tested for resistance to the cleaning agent Maxima 135 and to antibiotics to determine if the surviving bacteria represent a health concern to the wrestlers. The efficacy of Protect 'N Shield on the wrestling mats, the species identification of isolated colonies, and the results of drug resistance tests on the isolates will be discussed.

*Fyfe, Charles, Eric Benfield, Barrett Bradham; Kristy Johnson. Tau Nu. The Citadel. A Long-Term Study of Cortisol as a Biomarker for Chronic and Acute Stressors.

Stress has often been referred to as the 'silent killer' of humans. Over long periods of time. stress can increase the chance of heart disease, high blood pressure, and irregular heartbeat. In part, these negative health effects can be attributed to the physiological effect of prolonged exposure to high levels of cortisol, a steroidal hormone that increases rapidly in the bloodstream in response to both acute and chronic stress. While transient elevations of cortisol in the blood have been studied extensively, it has only recently been shown that cortisol deposited in growing hair is an accurate reflection of a systemic concentration over a long period of time. We conducted our study at The Citadel, a military college known for its rigorous regimented lifestyle and stressful fourth-class system for freshman cadets. We collected hair samples from freshman cadets before they matriculated and have continued to collect weekly hair samples, along with a corresponding weekly questionnaire detailing their weekly activities and perceived stress. We used an extraction protocol and enzyme-linked immunoassays to measure the cortisol levels from each sample. We then analyzed the data for long-term correlations between the cortisol concentrations before and after matriculation, along with the details of the questionnaires.

*honorable mention winner of the District I Johnson award

Wise, William, Durojaiye, Mustapha. Tau Alpha Tau. Gordon State College Identification of Resident Protozoa in the Gordon College Lake.

The Gordon State College pond is an abundance of life for aquatic and terrestrial Organisms. It is a living ecosystem that is home for fish, turtles and a nesting area for geese. Many terrestrial animals such as squirrels, deer and coyotes benefit from the pond as a water supply. However, something beneath the surface of the water is the foundation of life for the pond. Microbial protozoa are playing their ecological role, yet remain invisible to the naked eye. In hopes of uncovering their identities I began collecting samples from four locations that were equal distances from each other.

These locations were also on opposite sides of the pond from each other. I began collecting samples twice a week, once in the morning and then again in the afternoon, for seven weeks. At each collection, I would also record the water temperature to correlate the amount of protozoa actively according to temperature. then began examining the samples collected under a light microscope, where I was able to take pictures of the protozoa's found. As the temperature lowered it was harder to find the same protozoa, I found early in the experiment when the temperature was warmer.

W. Ducan Rhoad, V, Steven E. Woodyard, Jr., and Danny J. Gustafson. Tau Nu. The Citadel. Developing *ex situ* Protocols for the Endangered American Chaffseed.

Schwalbea americana (American chaffseed) is an endangered hemi-parasitic plant species that can be found primarily in the Atlantic and Gulf Coastal Plains open pine forests. Reintroduction of the natural fire dynamics to these fire dependent plant communities have stabilized some S. americana populations, but there is still a need for additional plants for population augmentation and restoration efforts. The limited primary literature suggests high seed production and no cold stratification requirements for high seed germination, however to ex situ propagation is be largely unsuccessful. We observed less than 10% seed germination without cold moist stratification. Following recommendations from the USDA Forest Service National Seed Laboratory (GA), we observed germination rate >75% following 30 days of cold moist stratification. We used these pretreated seeds from two different South Carolina sources, two different growth mediums, and soil microbes (added or not) from a S. americana population in the Francis Marion National Forest (SC). Five seeds were added to each pot and grown under greenhouse conditions beginning on 11/1/13. After two and a half months, the number of plants in each pot was recorded. There were significant (F_{1.287}= 5.03, P=0.026) 3-way ANOVA (source, growth medium, microbe) interactions attributed to differences in germination and establishment difference between source populations, growth medium, and native soil microbes. In general, greater germination and establishment occurred when microbes from the natural habitat were included in the growth media. Introduction of native microbial communities may be required to successfully propagate Schwalbea americana ex situ.

Wilson, Andrea. Psi Pho. University of North Georgia. Evaluation of control strategies for the soybean pest *Chrysodeixis includes*.

The United States generates half of the world's soybean (*Glycine max*) crop. Soybeans are subject to several pests, and in the Southeast, crop loss and pest management totaled \$1.2 million. Soybean loopers (*Chrysodeixis includens*), whose larvae feed on soybean leaves can be managed with multiple strategies including pesticides and genetically modified (GM) soybeans, but these control efforts are hindered because *C. includens* has developed resistance to many pesticides. To evaluate these strategies, we exposed *C. includens* to GM soybeans and Spinosad, an insecticide to which *C. includens* has shown no evidence of resistance. Time spent in each instar and weight at pupation were measured. Populations reared on GM soybeans and conventional soybeans had similar time in each instar and low pupation weights. Populations reared on GM soybeans and Spinosad died before pupation, but populations reared on GM soybeans spent more time in the larval stages than the populations treated with Spinosad. Comparison between Spinosad and GM soybeans in a lab setting showed that Spinosad is a better control mechanism due to the limited time spent in the larval phase before death.

MICHAEL KHAYAT¹, James W. Brown², Melanie Lee-Brown¹, Robert Whitnell. Sigma Phi. Guilford College¹ Departments of Biology and Computing Technology and Information Systems, NC State University² Department of Biology. Modeling and Mutagenesis of the FMN Riboswitch.

Riboswitches are RNA structures that bind metabolites, and via alternative secondary structures modulate downstream gene expression in bacteria. We are using homology modeling to identify key nucleotides involved in the binding of flavin mononucleotide (FMN) to the FMN riboswitch of *Chromobacterium violaceum*. Proposed mutations will be studied computationally and promising mutations will be created molecularly at key positions in the aptamer/ligand-binding domains of the riboswitch. The affect of the mutations on ligand binding will be compared through biochemical and phenotypic analysis.

Biggs, Jeannette, Melanie J. Lee-Brown, James W. Brown. Sigma Phi. Guilford College. Multi-locus-sequence-typing of *Azotobacter zettuovi:* an organism without a place.

Azotobacter sp. ATCC 49359 (known informally as "Azotobacter zettuovi"), was isolated in Holland in 1960 by S. Rowinski and deposited in the American Type Culture Collection (ATCC) by P. Jurtshuk of the University of Texas Houston, Azotobacter sp. ATCC 49359 is a gram-negative, nitrogen-fixing, free-living, soil bacterium that remains officially unrecognized and uncharacterized. Phylogenetic analysis of the 16S and RNase P genes, from this lab, placed Azotobacter sp. ATCC 49359 in the genus Azomonas, most closely related to Azomonas insignis. Azomonas, Azotobacter, Azorhizophilus and Pseudomonas are all genera of the family Pseudomonadacea. The taxonomy of this family is based on superficial morphological and biochemical traits, and as a result is a poor match to the phylogenetic relationships between member species. This study will use multi-locus sequence typing (MLST) of nine genes, consisting of house-keeping and DNA repair, as well as genes for traits specific to this family, to further support the placement of Azotobacter sp. ATCC 49359 in the genus Azomonas. Additional methods of characterization will be used according to the specifications of the International Journal of Systematic and Evolutionary Microbiology (IJSEM) to support the placement of Azotobacter sp. ATCC 49359 in the genus Azomonas and to formally recognize it as "Azomonas zettuovi".

Labrecque, Bethany and Tracy Deem. Nu Upsilon. Bridgewater College. Interactions between the LL-37 Peptide/self-DNA complexes with MHC-II on dendritic cells and a potential link to autoimmunity.

Some human autoimmune diseases have been linked to dendritic cell (DC) activation by self-DNA/ LL-37 complexes, which activate effector immune cells, leading to the symptoms of these diseases. However, it is unclear if activation of effector cells is due directly to antigen presentation of these complexes or indirectly through cytokine production by DCs. Therefore, we investigated whether DCs present LL37 from these complexes on major histocompatibility complex (MHC) molecules and thus suggest a role for direct activation of effector cells through antigen presentation. To address this question, we isolated peripheral blood mononuclear cells and incubated them with LL37/DNA complexes. MHC molecules were immunoprecipitated and the presence or absence of LL-37 was determined by SDS-PAGE gel electrophoresis and Western blotting analysis. Two trials revealed significant bands on the Western blot in the lanes of cells stimulated with these complexes. Therefore, these data suggest that LL-37 (by its presence on MHC molecules) could elicit direct T cell activation, an area for future

investigation. Future studies will also determine if cytokine expression is altered between cells treated with LL-37 alone or LL-37/DNA complexes. Better understanding of the mechanisms for autoimmunity potentially will contribute to a more effective treatment for some human autoimmune diseases.

Burton, Derek and Edmund Stellwag. Tau Gamma. East Carolina University. The Effects Of Ethyl Benzene on Heart Development in Zebrafish.

Congenital heart disease is the most common type of birth defect in the United States. Dr. Gail McCarver and researchers of the Medical College Of Wisconsin, Department of Pediatrics, found that fetal ethyl benzene exposure was associated with a 3.8 fold increase in congenital heart disease in infants. Ethyl benzene Is found in petroleum and released into the environment by vehicle exhaust and tobacco smoke. As a result of the Gulf Oil Spill in 2010, many marine organisms were dramatically affected by the crude oil exposure. The purpose of this research is to understand the effect of chemicals found in oil pollution on development and function of the vertebrate heart in zebrafish. Dr. Edmund Stellwag's (East Carolina University, Department Of Biology) research shows that embryos exposed to crude oil develop defects in heart development, beginning with pronounced pericardial edema and advancing to wasting of heart tissue. Understanding this, I hypothesize that exposure of zebrafish to ethyl benzene will result in developmental heart defects similar to those induced by crude oil. To test this, treatments of varying concentrations of ethyl benzene were exposed to a culture of 50 embryos, heart development in experimental and control embryos were examined, and statistical methods will be used to determine differences in treated and untreated embryos after measuring structures and functions of the developing heart. The preliminary data generated from the treatments does not produce the same results observed by crude oil. Therefore, the association between congenital heart disease and fetal ethyl benzene exposure could not be observed using zebrafish as a model system.

Pivar, Jennifer and Tracy Deem. Nu Upsilon. Bridgewater College. Changes in phenoloxidase activity during the development of *Callosobruchus maculatus* larvae on pesticide-treated beans: a role of the innate immune system in pesticide resistance.

This study aims to develop an assay to detect phenoloxidase (PO) activity in Callosobruchus maculatus larvae and determine if the enzyme plays a role during development if insecticide is present. Research suggests that changes in PO activity may correlate with increasing resistance to insecticides, likely through mechanisms similar to encapsulation of a parasite. A series of experiments were developed to optimize an assay for detecting PO activity. Black-eyed peas were treated with BT toxin, and beetles were allowed to develop for 2-3 weeks. Equal number of larvae were crushed and centrifuged in a DNA binding column to separate out the hemolymph. The hemolymph was pipetted onto filter paper with L-DOPA and incubated. Pictures were taken on a Bio-Rad gel doc station and analyzed using Image J software to quantify the color change due to the reaction between PO and L-DOPA. Preliminary data using this newly developed assay suggest that PO activity may increase as toxin concentrations increase; however, variances in data for untreated beans complicate conclusions. Therefore, further studies are needed to determine if changes in PO activity correlate with resistance to pesticide and if this new assay is sensitive enough to detect small changes in PO activity.

Hartman, Ashley and Tracy Deem. Nu Upsilon. Bridgewater College. Complexes of LL-37 and bacterial DNA or self-DNA have varying effects on endothelial cell ICAM-1 expression.

Psoriasis is an autoimmune disorder of the skin. Previous mechanism studies have suggested that LL-37, an anti-microbial peptide released by the skin in response to trauma, complexes with self-DNA and protects it from degradation. These complexes of self-DNA and LL-37 are aberrantly taken up by dendritic cells resulting in release of cytokines and activation of other immune cells. However, it has not been shown if these complexes can activate endothelial cells, which would exacerbate leukocyte migration into the skin. Therefore, we stimulated human umbilical vein endothelial cells (HUVECs) with LL-37 complexed with self-DNA or bacteria DNA and examined endothelial cell activation by monitoring increases in intracellular adhesion molecule (ICAM)-1 expression. We found that LL-37 alone, self-DNA alone, or LL-37 complexed with self-DNA did not increase ICAM-1 expression. However, bacteria DNA increased ICAM-1 expression, which was blocked when bacteria DNA was complexed with LL-37. Mechanisms for this increase in ICAM-1 expression by bacteria DNA has not been addressed nor why LL-37 complexed with bacteria DNA blocks ICAM-1 expression. These data suggest that LL-37 complexed with self-DNA may not play a role in endothelial cell activation during autoimmune diseases, but endothelial cells can be activated by bacteria DNA during a bacterial infection.

Worley, Jonathan. Sigma Phi. Guilford College. Characterization of Pseudomona sp. ATCC 55646.

The Pseudomonadaceae family comprises several genera of Gram-negative, free-living gamma proteobacteria including the genera Pseudomonas, Azotobacter, Azophizophilus, Azomonas, Mesophilobacter, Cellvibrio, Rugamonas, Serpens and Rhizobacter. Historically, organisms were assigned to genera within this family based on morphological and biochemical traits, including the ability to fix N₂ or form cysts. In the last 10 years, phylogenetic analysis of 16S rDNA and other stable RNAs has lead to reconsideration of the taxonomy of this poorly defined phylogenetic group. The research conducted in this study focuses on metabolic characterization and phylogenetic analysis of Pseudomonas sp. (ATCC 55646). This organism was isolated from a soil sample in Bridgewater, New Jersey during a study on aerobic degradation of aromatic and aliphatic compounds in waste materials and deposited in the American Type Culture Collection (ATCC) by Cytec Industries. Upon completion of this study it will be determined whether Pseudomonas sp. (ATCC 55646) can be identified as a member of a preexisting species in the family Pseudomonadaceae or whether it is a novel species worth further characterization.

Massa, Nicole. Sigma Psi. Florida Institute of Technology. Kin Recognition in *Arabidopsis thaliana*.

The roots are the primary route for water and non-carbon nutrient uptake by most terrestrial plants. As neighboring plants compete for the limited nutrient pool available in the soil they must adjust their root system architecture (RSA) and total body plan accordingly. On-going laboratory studies with a variety of plant species suggest that the degree to which the RSA is modified depends, at least in part, on the identity of these competitors. These studies suggest that plants are capable of 'kin recognition', i.e. the ability to distinguish between members of the same species which are more closely related than others. It is currently unclear how these interactions may benefit plants as well as their occurrence under native conditions. Collections of wet and dry weights as well as measurements of plant growth stage will be used as an indicator of the overall effects of kin recognition. I hypothesize that reduced competition between plants which are less closely related (kin) will result in reduced growth relative to interactions between plants which are less closely related (stranger).

Teter, Christina; Puffenbarger, Dr. Robyn. Nu Upsilon. Bridgewater College. Identifying prey from fecal sacs of *Poecile carolinensis* and *Sialia sialis* via DNA barcoding.

The abundance of a predator is significantly impacted by the abundance of its prey. Therefore, it is essential to know the exact prey of organisms to better understand the food web's control over populations. We analyzed the prey of nestling Carolina Chickadees (*Poecile carolinensis*) and Eastern Bluebirds (*Sialia sialis*) since they are fed primarily insects and arachnids, but the exact prey species may not be known. We obtained fecal samples from the field. We amplified prey DNA with PCR by using primers specific for insects and arachnids. For amplified samples, we utilized the Zero Blunt system to clone DNA for sequencing. We randomly chose four colonies to purify plasmid DNA and then sent the products off for sequencing. After obtaining the results, we checked them against a reference library of short genetic sequences for the identification of various known species, which is known as DNA barcoding. Our Carolina Chickadee sample yielded DNA from the *Heliconius* genus (brushfoot), *Cosmopterix* genus (leafminers), and *Arita* genus (grass skipper), which was found twice. While the results are limited since the Eastern Bluebird samples did not yield DNA sequences, we do have protocols to use on future samples.

Farias-Solanas, Bernarda; Amanda Helton; Ryan A. Shanks; Steven A. Lloyd. Psi Rho. UNG. Does methylphenidate exposure alter BDNF expression in prefrontal cortex and striatum of C57Bl/6J mice?

Methylphenidate is an important psychoactive drug used in the treatment of ADHD. Psychoactive drugs are known to cause plastic changes on the developing brain, affecting the expression of different genes. BDNF is a growth factor implicated in these plastic changes. BDNF protein is responsible for the growth, differentiation, and maintenance of neurons; low levels of this protein can result in an alteration in neural development and are linked to different neurodegenerative disorders. In our previous behavioral work, prenatal and adolescent exposure to MPD showed behavioral alterations in mice. In this study we will measure the levels of BDNF in order to determine if MPD is the cause of these changes in behavior by altering BDNF expression. Female and male C57Bl/6J mice were exposed to 10 mg/kg MPD or saline during these key developmental windows. RNA was isolated from the prefrontal cortex and striatum of these mice, and was analyzed via qPCR. We expect to see decreased levels of BDNF expression in MPD-treated mice. This result would support the hypothesis that MPD can lead to neural alterations, which have underlying molecular mechanisms leading to behavioral alterations.

*Bedsole, Sidney E. Tau Gamma. East Carolina University. Investigation of Mcm10 Heterochromatic function in C-Terminal Domain.

Mcm10 is a gene demonstrated to be involved in the initiation of DNA replication and heterochromatin formation, and has recently been cited as one of the top ten genes found to be altered in many cancerous states. Though recent research has associated aberrant Mcm10 expression with many types of cancer, the exact function of Mcm10 in replication and chromatin dynamics has remained elusive. As our understanding of the importance of epigenetic control of the genome grows, we have gained insight into the importance of chromatin structure on genome stability and proper gene expression; therefore, a thorough understanding of Mcm10's function in the formation of chromatin states could further our understanding of the mechanisms underlying oncogenesis. This project focuses specifically the regions of Mcm10's C-terminal domain that affect the heterochromatic function of the protein as a whole. To assess the regions of Mcm10's C-terminal domain that play a role in chromatin dynamics, we have evaluated the impact of

20 different point mutations on the formation of heterochromatin using a position effect variegation (PEV) assay. By utilizing a white-mottled-4 reporter line we were able to assess the formation of heterochromatin using a simple spectrophotometric test. Through these investigations we have discovered regions of Drosophila Mcm10's C-terminal domain that significantly impact the formation of heterochromatin. These results provide some insight into the possible correlation of cancerous states with altered Mcm10 expression, as improper chromatin establishment can have serious impacts on genome stability. These results combined with other data generated in our lab are adding to a growing body of data that will be used to assess the essential functions of Mcm10 in eukaryotes.

*honorable mention winner of the District I Johnson award

Narzynski, Annette. Sigma Psi. Florida Institute of Technology. Functional architecture of the retina in predatory marine fish.

The spectacularly beautiful lionfish, popular in the aquarium trade, has successfully invaded the waters of the western Atlantic Ocean and now ranges throughout the Atlantic seaboard, the Gulf of Mexico, the Caribbean and northern South America. They are highly efficient predators with few natural enemies because of their venomous spines. As lionfish continue to spread and populations grow, they present an ever-increasing threat to sensitive reef ecosystems. Lionfish are visually-quided predators as suggested by their large eyes, but compared to other vertebrate species including many other bony fishes. essentially nothing is known about the lionfish visual system. This study utilized the most common invasive lionfish in Florida, the red lionfish (Pterois volitans), in an investigation of the functional architecture of its retina. Using histology, immunofluorescence, and light and laser-scanning confocal microscopy, retinal structure was characterized and the distribution and relative number of rod and cone photoreceptors was assessed. The convergence ratio of photoreceptors to ganglion cells was used to estimate of visual acuity. Results of this work will be used in conjunction with behavioral experiments to better understand the relationship between neural organization and behavior in order to better understand the ecological effects of and hopefully control invasive lionfish populations.

Topper, Kayla. Nu Upsilon. Bridgewater College. Detection of 3-Hydroxybutyrate Dimer Hydrolase in Streptomyces sp. 5A.

Polyhydroxybutyrate (PHB) is a biodegradable, plastic-like polymer consisting of 3-hydroxybutyrate (3HB) monomers. Previous research has shown that degradation of PHB in the soil bacterium, *Streptomyces sp. 5A*, is carried out by a PHB depolymerase produced during growth on PHB. In other soil bacteria, PHB is first degraded to dimers of 3HB by a PHB depolymerase, and the dimers are then hydrolyzed to 3HB monomers by a 3HB dimer hydrolase. 3HB dimer hydrolase can be assayed via its esterase activity, using an artificial substrate, *p*-nitrophenyl butyrate (PNPB). Esterase activity has been identified in *Streptomyces sp. 5A*, but to confirm the esterase activity is due to 3HB dimer hydrolase the PHB depolymerase is being used to degrade the PHB, to provide a stock of the dimer. The dimer will then be purified via HPLC and characterized to be used as the enzymatic substrate for the hydrolase assay. Testing this enzyme with the real 3HB dimer substrate as opposed to an artificial one will allow for confirmation that this hydrolase is used in the degradation of 3HB dimers.

Cullip, Megan. Nu Upsilon. Bridgewater College. The Phylogenetics and Conservation of a Rocky Outcrop genus (*Phemeranthus*).

The genus Phemeranthus includes many species of flowering plants that thrive on xeric, rocky outcropping habitats. The entire rocky outcropping ecosystem is threatened due to the encroachment of pine and woody species that produce shade and leaf litter, upsetting the balance of this ecosystem, and in turn, posing a threat to the future of Phemeranthus. Therefore, this study put into place a conservation project involving the propagation of P. mengesii in a greenhouse and in situ transplantation to unoccupied suitable habitat patches. Both of the conservation efforts were proven to be successful with viability achieved by all involved individuals. Previous studies have sought to clear up the relationships and evolutionary history between the species within Phemeranthus, however, all have shown to be inconclusive in regards to the Eastern North American clade. This study sought to clear up these ambiguities that include the relationships between P, mengesii, P. calcaricus, P. parviflorus, and P. teretifolius, Bayesian and maximum likelihood analysis were used to construct a phylogenetic tree based on sequence data using the loci matK, rbcL, and tmH-psbA. The analysis recovered P. mengesii and P. calcaricus as monophyletic. However, the relationships between P. teretifolius and P. parviflorus have yet to be resolved.

Mion, Giuliano, Anna Frasier, Sumner Harris, Royce Dansby-Sparks, Steven Lloyd and Ryan Shanks. Psi Rho. University of North Georgia. Examination and quantification of hemosiderin deposits in the spleen of C57Bl/6J mice exposed to methamphetamine.

Methamphetamine (METH), a widely used psychostimulant, is known to produce drastic changes to different system throughout the body by increasing vasodilation, blood pressure, and heart rate. The spleen is a multifunctional organ to include immune, hematopoietic, and filtering of effete red blood cells. Alterations in splenic function can indicate local and/or systemic toxicity. We noted qualitative changes in the spleens of mice exposed to chronic METH and include gross weight changes, hemosiderin deposition, and morphological alterations in red and white pulp when compared to saline controls. Overabundant iron has detrimental effects on the body via oxidative phosphorylation and mitochondrial dysfunction leading to cell death and organ damage. We will quantitate the observed iron increases in the spleen of 14 male C57Bl/6J mice given daily i.p. injections of 5mg/kg METH or saline for 10 days. The spleens were removed, homogenized, and dry ashed using heat to remove organic content. The total iron content will be determined using a colorimetric assay in which organic materials are burned off, iron dissolved in nitric acid, and concentrations obtained with fluorescence spectrometry. Future experiments will be conducted to examine iron deposits in other organs as well as to determine the mechanism by which deposition occurs.

Hill, Haley M., Ashley C. Sturm, Casey Whitehead and Nancy Eufemia Dalman. Psi Rho chapter. University of North Georgia. The effects of environmental toxicants on Fundulus heteroclitus behavior and p - glycoprotein activity.

Killifish (*Fundulus heteroclitus*) inhabit coastal salt marshes where they may be exposed to toxic runoff from land. They are an important mid – level organism in the salt marsh food web, feeding on small macroinvertebrates and in turn providing food for wading birds and larger fish. Changes in killifish populations, due to toxicant exposure, may have dramatic effects on the entire salt marsh food web. Killifish were collected from tidal creeks on Sapelo Island, GA. After a seven - day acclimation period, fish were exposed to environmentally relevant concentrations of the insecticide malathion for 4 or 48 hours and then fed white shrimp *ad libitum* for 20 minutes. Fish exposed to malathion consumed less

shrimp than unexposed control fish, with a general decrease in consumption as the malathion concentration increased. Malathion — treated fish also had diminished optomotor activity, suggesting that malathion, a potent neurotoxin, was having an adverse effect on the killifish nervous system. Killifish feeding studies are currently being conducted using other environmental contaminants. Additionally, we are measuring the titer of the cell membrane transport protein p — glycoprotein, known to pump organic toxicants from liver cells, to link exposure consequences at the cellular and behavioral levels.

Sagoo, Rajpal, Jessica Vincent, Miriam Segura-Totten. Psi Rho. University of North Georgia. Regulation of Barrier-to-Autointegration Factor (BAF) Binding with Histones.

Barrier-to-Autointegration Factor (BAF) is a protein that is found both within the cytoplasm and nucleus in metazoans. BAF exists as a homodimer *in vivo* and plays an important role in gene expression and nuclear assembly. It can bind to integral membrane proteins such as LAP2β, Emerin, and MAN1 (also known as the LEM domain proteins). BAF also assists in the condensation of chromatin into higher-ordered structures through its interactions with histones. Previous research has shown that BAF binds histones H1 and H3 and the chicken-specific linker histone H5. Barrier-to-Autointegration Factor-Like (BAF-L) is a protein that is 40% identical and 53% similar to BAF at the amino acid level. While BAF-L can interact with histones on its own, it cannot interact with DNA unless in the heterodimerized form with BAF. These observations lead us to believe that BAF-L may be a regulator of BAF. We will explore this hypothesis by creating BAF/BAF-L heterodimers with purified recombinant proteins and performing various protein interaction assays.

*Penrod, Louis. Sigma Psi Chapter. Florida Institute of Technology. The effects of temperature on invasive-predator and native-prey interactions in fishes.

Invasive species have negative ecological and economic consequences for their invaded ecosystems. The ability of invasive species to adapt to environmental conditions has motivated research investigating the effects of environmental temperature on organismal performance. The effects of temperature on feeding performance in invasive fishes have been focused on the predator-response. However, temperature-induced changes in physical properties of water and physiological systems affect predator and prey. This study investigates the effects of temperature on the relationship between invasive fishpredator (Belonesox belizanus, Pterois volitans and Cichlasoma urophthalmus) and native-prey (Gambusia holbrooki). The distance traveled by predator toward prey (Ramfeeding) was greater than distance traveled by prey toward the predator's mouth (Suctionfeeding) during prey-capture. However, the magnitude of ram-feeding relative to suctionfeeding (Ram-Suction Index) increased with temperature. Temperature sensitivity (Q10values) of both predator and prey declined with increasing temperature. These results indicate that responses of invasive-predator and native-prey must be addressed by ecologists when investigating the consequences of temperature for the management of invaded ecosystems. Furthermore, the ability of invasive-predators to modulate their feeding performance in response to temperature enables them to successfully expand their invasive-range of distribution as higher latitude ecosystems experience higher temperatures as a consequence of climate change.

*honorable mention winner of the District I Johnson award

Williams, Kori and Vinoth Sittaramane. Tau Kappa. Georgia Southern University. Role of Autism Susceptibility Gene Topoisomerase3B in Zebrafish Neural Development.

Neurodevelopmental disorders, such as Autism, require further research and investigation. While much is known about the behavioral characteristics of these disorders, little is known in regards to the cellular and molecular alterations underlying these disorders. Genetic research in the Northern Finnish human population has strongly linked polymorphisms in *topoisomerase 3B* (*top3b*) gene with neurodevelopmental disorders such as schizophrenia, autism, and other cognitive impairments. Human autism susceptibility gene, *top3b*, has been shown to play a role in synapse formation in flies. Using zebrafish embryos as a vertebrate model system, we are investigating to identify the role *top3b* plays in neural circuit development, and how it can be translated to human application. Our preliminary experiments indicate that *top3b* deficiency results in axonal guidance defects in zebrafish embryos injected with a *top3b* antisense nucleotides. Zebrafish models are used because of the ease of replication, manipulation, and embryological similarities to humans in development. Behavioral and molecular studies will be conducted in *top3b* deficient embryos, along with screening for drug targets, in hopes of finding therapies for neurodevelopmental diseases.

Patel, Parth. Beta Omega. Mercer University. Sequencing Allelic Series in Coding and Non-coding Regions of the Human Genome.

Single nucleotide polymorphisms (SNPS) were determined for allelic series in both a coding and a non-coding region in the Human genome. The allelic series for the coding regions was from the *PKU* (phenylketonuria) gene. Phenylketonuria, an autosomal recessive metabolic genetic disorder, is caused by the mutation in the gene for the phenylalanine hydroxylase enzyme. The phenylalanine hydroxylase enzyme is crucial in metabolizing the amino acid Phenylalanine to Tyrosine; thus the DNA sequence of this coding region should be fairly conserved. We also sequenced an allelic series from a non-coding region for comparison. Our non-coding sequence is from the *TPA-25* locus. *TPA-25* is a commonly used molecular marker that contains an *Alu* fragment; the *Alu* insert is found within the intron of the tissue plasminogen activator gene. We will compare the rates of transitions, transversions, and single base-pair additions or deletions in the coding region versus the non-coding region.

*Sadanani, Manisha and Kristen Horner. Beta Omega. Mercer University. The Role of the Striatal Patch Compartment in Addictive Behaviors.

The striatum is a component of the basal ganglia that is critically important in the regulation of movement. The striatum can be divided into the patch and matrix compartments based on physiological and anatomical features. The specific functions of these compartments are not completely understood, but several lines of data have suggested that the patch compartment may mediate internally-cued, repetitive behaviors. while the matrix compartment may mediate processing of external sensorimotor information. It has also been suggested that enhanced activation of the patch compartment may also mediate habit formation in addiction. In support of this notion, previous studies have shown that animals will repeatedly self-stimulate when an electrode is placed in or near the patch compartment, indicating that this region of the striatum may mediate reward and motivationally-based behaviors. We hypothesize that activation of patch-based circuits during drug administration contributes to the expression of addictive behaviors. This study will involve the use of the neurotoxin DERM-SAP to selectively ablate the patch compartment prior to methamphetamine (METH) exposure, and conditioned place preference to assess subsequent effects on METH-induced motivation. This study will be among the first to clarify the role of the patch compartment in the development of psychostimulant-induced addictive behaviors.

*first place winner of the District I Johnson award

Sheikh, Maaz. Beta Omega. Mercer University. Sequencing Allelic Series in Introns and Exons of the Human Genome.

Single nucleotide polymorphisms (SNPS) were compared in an intron to an exon in the human genome. The gene chosen for this analysis was the phenylalanine hydroxylase (PAH) gene, which can give rise to the disease phenylketonuria (PKU) when mutated. Amplification through PCR and purification through gel electrophoresis were necessary methods to isolate the necessary fragments. Samples displaying bands from PAH primers were further sequenced using the Sanger chain termination method. The intron and exon sequences collected were compared each other. Transitions versus transversions and single base pairs additions versus deletions were factors analyzed to calculate both the nature and rate of mutations between introns and exons in the human genome.

*Spillman, Taylor, Finn Furstenwerth, Duncan Cameron, and Jay Bolin. Tau Eta. Catawba College. Isotopic Investigation of Mycoheterotrophy in the Southern Blue Thread (Burmannia capitata).

The Burmanniaceae contain several lineages of achlorophyllous mycoheterotrophic plants that may associate with arbuscular mycorrhizal fungi (AMF). Here we investigate the isotopic profile of a green and potentially mycoheterotrophic wetland plant in situ, Burmannia capitata, the Southern Blue Thread, and associated vegetation. We generated 13C and 15N stable isotope profiles of a population of *B. capitata* from the Sand Hills Game Lands in Scotland County, North Carolina. The shoots of *B. capitata* are indistinguishable from other C3 reference vegetation but did show significant depletion in 13C relative to C4 reference vegetation. The highest 15N values were observed in the *B. capitata* shoot. The 13C signal of *B. capitata* root was significantly enriched relative to the C3 reference vegetation root fraction, suggesting a signal from mycorrhizal associates. Within the genus Burmannia transitions to full mycoheterotrophy have occurred numerous times suggesting that some green Burmannia species are likely partially mycoheterotrophic. Further investigations of mycorrhizal associate using isotopic, molecular and microscopic methods are planned.

*second place winner of the District I Johnson award

*Lee, Brittney. Tau Gamma. East Carolina University. Is Aggression Mediated by Androgens in Females that posses Male Ornaments?

Social and physiological mechanisms can greatly impact the development and evolution of colorful biodiversity. The phenotypic variation in threespine stickleback fish (Gasterosteus aculatus) is a classic product of such mechanisms where, in some cases, populations harbor females that express atypical masculinized red-throats. While the mechanisms underlying the trait in females are not completely known, in males variation in red throat is associated with aggression and male-typical hormones. Thus, it was hypothesized that the female red throats may have evolved in the context of social competition and be mediated by the male typical hormone, 11-ketotestoterone (11KT), such that red-throated females are more aggressive and release higher levels of systemic 11KT. Using field-collected sticklebacks, we subjected resident females to a territorial intrusion simulation, and tested whether females with red throats were more aggressive and released more waterborne 11KT. While we observed a relationship between body size and red throat intensity and significant changes in throat coloration before and after the social interaction, our results revealed no clear relationship between throat color, aggression, and waterborne 11KT. Females with intense red throats were not more aggressive and did not mount an elevated

hormone response after the social interaction. Interestingly, a hormonal pattern emerged where females released significantly more 11KT at 1hr and 2hr post- social interaction, suggesting that females may mount a slow socially driven- hormonal response rather than immediate. While we observed no strong association between the 11KT androgen, aggression and female throat coloration, our study provides insights on the covariation between a candidate hormone, behavior, and female ornamental traits.

*third place winner of the District I Johnson award

DISTRICT II JOHNSON AWARD SESSION – POSTERS HERITAGE BALLROOM

*Gossen, John. Mu Theta. Belmont University. Feeding Preference of *Armadillidium vulgare* on Exotic and Native Plants.

Generalist decomposers play an important role in the recycling of nutrients in ecosystems. The occurrence of different plant species can impact the community of decomposers. Invasive exotic plants have infiltrated many local habitats and their leaf litter may be a less preferred food source for generalist decomposers. Using choice chambers, the isopod Armadillidium vulgare was given the option of exotic or native leaf litter to feed upon. Exotic species (e.g., Euonymus fortunei and Ligustrum sinense) and native species (e.g., Smilax sp. and Parthenocissus quinquefolia) were offered to the isopods for 6 hours. To determine plant preference, the number of isopods in exotic and native chambers was counted. Additionally, feeding preference was assessed by calculating percent of leaf area consumed. Multiple trials of 250 individual isopods suggest that isopods preferentially feed on native rather than exotic leaf litter. The introduction of exotic plant species might change the rates at which leaf litter is decomposed and nutrients recycled, as well as the distribution of invertebrate decomposers.

*third place winner of the District II Johnson award

Brislinger, Allyson, Tyler Creamer, Kassandra L. Pattison, Kali Sands, Carly Williamson, Kristi L. Jones. Beta Nu. Huntingdon College. The use of Computational Analysis to Identify Genes of the Fourth Chromosome (Contig 61) of *Drosophila biarmipes*.

Comparative genomics was used to construct gene models in a portion of the fourth chromosome in Drosophila biarmipes. The fourth chromosome, or F element, is largely heterochromatic but has 80 expressed genes. Drosophila melanogaster was used as the reference species. Computational analysis tools utilized included BLAST, Flybase, and the Genome Browser from Genomics Education Partnership (GEP) website (mirror of UCSC genome browser), which is where we gathered together our lines of evidence to evaluate the exon structure for each isoform. To begin annotation, we first found that our chromosome segment contained genes that were orthologus to retinoid-and fatty acidbinding alvcoprotein, activin beta, and shaven. Structural genomics was conducted using available data to assign the start and stop of each exon. The initial methionine and stop codon, as well as splice sites for each exon, were also mapped to the base pair. This information, taken together with other student annotation projects from GEP, is beneficial in forming a complete set of gene models for D. biarmapies fourth chromosome. This data taken together will allow functional studies and shed light on an interesting chromosome. A GEP project supported by HHMI grant # 52005780 to SCR Elgin at Washington University in St. Louis.

LeBlanc, Crystal. Mu Theta Chapter. Belmont University. The Evaluation of Type I Interferon Levels in HPV-Positive Cervical Cancer Cell Lines.

Human Papillomavirus (HPV) is the most common sexually transmitted virus in the United States and the leading cause of anogenital and oropharyngeal cancers. Previously, it has been determined that levels of IRF-3, a transcription factor allowing for expression of antiviral type I interferons, are reduced in HPV-positive cervical cancer cell lines. As an extension of this work, we wanted to determine if type I interferon levels themselves are also reduced in the presence of HPV by Western Blot analysis. We confirmed decreased levels of IRF-3 in HeLa cells versus C33A cells. Original analysis of cell lysates revealed faint expression of Interferon-a and Interferon-b for both cell lines, however, the levels were too low to distinguish between the samples. Given that Interferon-a and Interferon-b are secreted proteins and their levels of expression in cell lysates were so low, we next examined supernatants for Type I interferons. Analysis of supernatants indicate possible dimer formation of the Type I interferons in C33A and HeLa cells. Future studies can compare levels of the secreted interferons between C33A and HeLa cells. Taken together, these results may indicate that HPV can suppress antiviral activity downstream of IRF-3 and potentially contribute to immune evasion and cancer progression.

*Worthy, Samantha. Mu Omicron. Columbus State University. Confirmation of Herbal Medicines Using Plant DNA Barcoding.

Medicinal plants are a precious part of the world's flora. More than 85,000 species out of the 250,000 higher plants on Earth are reported to have some medicinal value. Plants have been used for thousands of years as remedies to cure the sick and now a growing number of Americans are turning to naturopathic medicines because of their low cost and decreased side effects. Recently, a number of studies have shown that DNA barcoding is an effective technique for product verification of naturopathic medicines. The goal of my research is to employ the use of DNA barcodes as a tool for the genetic confirmation of naturopathic plants. Specifically, my objectives are 1) to extract DNA from ~ 50 manufactured naturopathic medicines, 2) sequence the *rbcL* barcode gene region of the chloroplast genome for each and, 3) verify their genetic identity to manufacturer labels. The use of DNA barcodes has proven to be an effective technique for obtaining high quality genetic sequences for ~ 30% of the samples tested and has revealed discrepancies between the manufacturer's labeling and true genetic identity. This research underscores the potential broader use of DNA barcodes to assess the quality of naturopathic medicines.

*second place winner of the District II Johnson award

*Lamberth, Elizabeth. Mu Omicron. Columbus State University. The effect of Topamax on the Amyloid Beta Protein of Astrocytes.

Topamax, an antiepileptic drug, has been shown to effectively reduce the number of monthly migraines in patients. Topamax blocks the voltage-dependant sodium channels and enhances GABA activity at nonbenzodiazepine sites on the GABA(A) receptor. When GABA(A) is activated by Topamax, chloride ions enter and hyperpolarize the membrane preventing an action potential. The amyloid beta protein, whose accumulation is a hallmark of Alzheimer's Disease, is directly inhibited by activation of GABA(A) receptor in neurons. This experiment tested the amyloid beta protein levels following Topamax treatment of mouse astrocytes *in vitro*. The hypothesis was that increasing Topamax concentrations would be associated with a decrease in the amyloid beta protein levels. C8-D1A astrocytes 1X6¹⁰ cells/ml were treated with Topamax (0.005mg/ml, 0.01mg/ml, 0.02mg/ml, or 0.04mg/ml) for either 24 or 48 hours. An ELISA was used to determine the

amyloid beta protein concentration using a spectrophotometer. A two-way ANOVA and a Tukey's post hoc test revealed that there was a significant increase in the amyloid beta protein following the highest Topamax treatment (p=0.039). These results differ from studies in cortical slices where an increase in GABA(A) activity results in a decrease in amyloid beta protein. This implies results are a function of cell type.

*first place winner of the District II Johnson award

Perkins, Darcy, Brittany Knight, Aubri Morgan, Natalie Johnson, Christi Magrath, and Teresa Moore. Mu Epsilon. Troy University. Nystatin and Fluconazole: stress response and filamentation in yeast.

Earlier analysis of the impact of antibiotics on filamentation in *S. cerevisiae* indicated that altered filamentation patterns were induced by fluconazole. Because *Saccharomyces* strains with sensitivity to stimuli by chemicals and drugs (according to gene ontology analyses) have displayed differing sensitivities and responses during growth analysis on media prepared with various (local) water samples, analysis of response to stress induced morphology changes in cell density, filamentation, and cell size upon exposure to butanol (filamentation inducer) and antibiotics was continued. Our continuing analysis examined if the filamentation/morphology patterns in yeast were altered antibiotic treatment with Nystatin. The effective concentration of Nystatin that reduces cell density (cells/ml) by half was determined, and this concentration was used to treat both wild type yeast and a Flo11 deletion mutant in media with and without butanol. Filamentous changes in yeast strains will allow determination of conditions that may allow antibiotics/drugs to alter filamentous activity and enable a better understanding of morphological stress responses in cells.

Jones Gibson, Megan, Andrew Clarke, Christi Magrath, and Teresa Moore. Mu Epsilon. Troy University. Impact of rutin on filamentation in Saccharomyces cerevisiae.

Yeast strains can be placed into a media that can induce filamentous growth to determine if the colony morphology is altered. In addition to filamentation, yeast exposed to stressful environmental conditions, particularly exposure to butanol, may also display altered response to plant extract (rutin) exposure. Therefore, the effective concentration of rutin that resulted in a reduction of cell density by fifty percent was determined. This concentration was used in additional studies to determine if the filamentation levels are altered in media supplemented with rutin, butanol, or a combination of the two. After exposure, microscopic examination allows assessment of elongation, clumping, size distribution, and other morphological changes. The exposure of yeast (S. cerevisiae) to the rutin will allow possible validation of the hypothesis that plant extracts will promote altered filamentation levels, possibly via induction of stress response.



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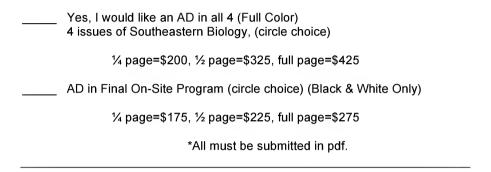
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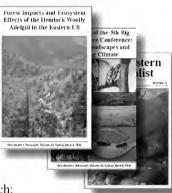
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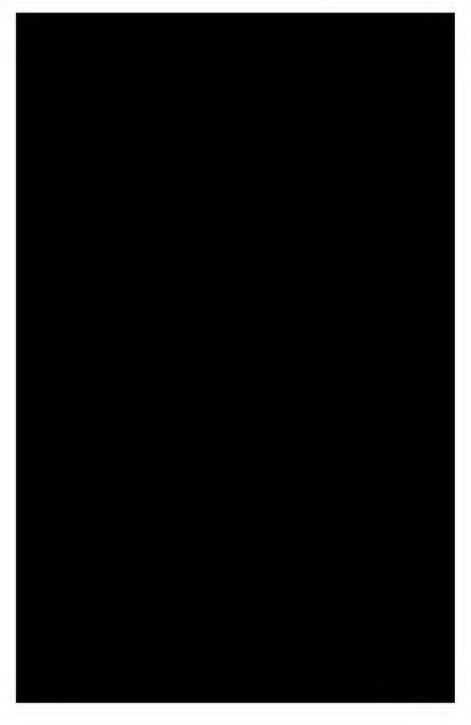
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OBITUARY

Professor Elsie Quarterman: In Memorium

1910-2014

Dr. Elsie Quarterman known fondly to her students as EQ passed away on 9 June 2014 at her home in Nashville, Tennessee, at the age of 103 years. She was born on 28 November 1910 in Valdosta, Georgia. Dr. Quarterman obtained her B. A. degree from Georgia State Women's College (now Valdosta State University) in 1932, after which she taught English in the Georgia public schools for 11 years. She obtained her M.A. degree in botany from Duke University in 1941 and her Ph.D. from the same institution in 1949. Her Ph.D. advisor was the renowned plant ecologist Professor Henry J. Oosting. EQ's M.A. degree was on the distribution of Compositae in Lowndes County, Georgia, and her Ph.D. degree on the plant communities of the cedar glades of middle Tennessee. She published papers from her dissertation in *The Bryologist* (1949), *Bulletin of the Torrey Botanical Club* (1950) and *Ecology* (1950).

Dr. Quarterman joined the faculty of Vanderbilt University as an instructor of biology in 1943 and was promoted through the academic ranks to professor in 1966; she served as Chair of the Department of General Biology from 1961 to 1963. EQ retired from Vanderbilt in 1976 and became Professor Emerita. In the academic world, Dr. Quarterman is best known for her work on the plant communities of the middle Tennessee cedar glades. She also is well known for the publication entitled "Southern mixed hardwood forest: climax in the southeastern Coastal Plain: U.S.A." coauthored with her long-time friend the late Dr. Catherine Keever and published in Ecological Monographs in 1962. Her first journal paper, entitled "A preliminary survey of the bryophytes of two cedar glades," was published in The Bryologist in 1947. Her last paper, which she coauthored with her former Ph.D. students Carol and Jerry Baskin, entitled "Flow diagrams for plant succession in the middle Tennessee cedar glades." was published in the Journal of the Botanical Research Institute of Texas in 2007. Altogether, Professor Quarterman authored or coauthored about 25 papers in referred journals. Another of her important scientific contributions was a chapter entitled "Rock outcrop communities: limestone, sandstone and granite" coauthored with M. P. Burbank and D. J. Shure and published in the "Upland Terrestrial Communities" volume of "Biodiversity of the Southeastern United States" edited by W. H. Martin and others and published by John Wiley & Sons in 1993. Additionally, after retirement EQ and Dr. Richard Powell, a geologist from Indiana, worked on a 5-year contract with the National Park Service to survey "Potential ecological/geological natural landmarks on the Interior Low Plateaus," a physiographic province that extends from southern Indiana, extreme southern Ohio and southern Illinois through central/west-central Kentucky and central Tennessee to northern Alabama. The 738-page document resulting from this work is a valuable contribution to our knowledge of the plant ecology, geology and physiography of the Interior Low Plateaus.

Professor Quarterman taught a wide array of courses in plant biology at Vanderbilt, including general botany, plant ecology, plant autecology, plant

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geography, systematic botany and plant anatomy. We took graduate courses in plant ecology, plant autecology and plant geography with her and today judge that her teaching was "ahead of its time." That is, EQ insisted that students engage in active learning *via* reading the literature rather than them listening to long detailed lectures and subsequently memorizing the notes for the exam—then quickly forgetting everything. Her method of teaching/training has served us well in research and in interpreting the scientific literature. Dr. Quarterman served as major professor for seven students who obtained a Ph.D. degree and for six who obtained the Master's degree. EQ was highly regarded as a teacher and in 1988 received the Association of Southeastern Biologists Meritorious Teaching Award.

Dr. Quarterman was a very gracious person and concerned about her graduate students. For example, she loaned us her personal car (with gas in the tank) on a number of occasions to visit cedar glades in middle Tennessee, northwestern Georgia and northern Alabama, in connection with our Ph.D. research in the mid-1960s. Also, Dr. Quarterman gave us money for gasoline to go on a field trip escorted by Dr. Delzie Demaree to Illinois in search of Astragalus tennesseensis (Carol's study species), after Jerry purchased a 1957 Ford. There were many field trips to the cedar glades, about which Dr. Quarterman had considerable expertise; she was always eager to share her knowledge on their unique flora and plant communities. We, along with several other graduate students, enjoyed several trips with EQ to various universities in the southeastern USA to attend the annual meeting of the Association of Southeastern Biologists. All these acts of kindness are remembered by us and other students, with much gratitude.

Dr. Quarterman served the scientific community in many ways, including Vice President of the American Bryological Society, President of the Association of Southeastern Biologists, Chair of the southeastern section of the Botanical Society of America and member of the Editorial Board of *Ecology* and of the *Plant Science Bulletin*. EQ was a member of the Executive Committee of the Tennessee Academy of Science, editor of the Journal of the Tennessee Academy of Science, and served on the Board of the Highlands (NC) Biological Foundation (Station). Professor Quarterman was a Fellow of the American Association for the Advancement of Science, of the Tennessee Academy of Science, and of the Association of Southeastern Biologists.

In addition to her university and society duties, Dr. Quarterman was very much engaged in conservation efforts, especially in Tennessee. She was a founder and active member of the Tennessee Protection Planning Committee (an inter-agency forum to coordinate efforts to preserve ecologically important areas in the state), a very active board member of the Tennessee Nature Conservancy for many years and served on the Tennessee Environmental Council. Dr. Quarterman played an important role in the preservation of a remnant virgin forest in Savage Gulf on the west-facing escarpment of the Cumberland Plateau in Grundy County, Tennessee, and inspired the preservation of Taylor Hollow on the Highland Rim in Tennessee. She was involved with the Tennessee Botanical Gardens at Cheekwood (in Nashville) for many years and served as Acting Director (1967-68). She was a member of Friends of Warner Park, Friends of Radnor Lake, a strong supporter of the Middle Tennessee State University Center for Cedar Glade Studies and worked with the U.S. Corp of Engineers to identify and preserve some of the cedar glade communities on Percy Priest

Reservoir Lands. For her conservation efforts, she received the Oak Leaf Award from The Nature Conservancy, the George B. Fell Lifetime Achievement Award from the Natural Areas Association and the Sol Feinstone Environmental Award from the State University of New York College of Environmental Science and Forestry.

Dr. Quarterman will be remembered as a fine southern lady who loved her family and students, studied cedar glades, had a deep appreciation of the value of natural ecosystems and worked tirelessly for the preservation of natural plant communities. In her honor, a 185-acre cedar glade in the U.S. Army Corps of Engineers Percy Priest Reservoir and Wildlife Management Area near La Vergne, Tennessee, has been named the "The Elsie Quarterman Cedar Glade," and the annual wildflower weekend at Cedars of Lebanon State Park in Tennessee has been renamed "The Elsie Quarterman Wildflower Weekend." Also, the Elsie Quarterman-Catherine Keever Award is given by the Southeastern Chapter of the Ecological Society of America for the best student poster at the annual meeting of the Association of Southeastern Biologists.

The thing that many people will remember about Dr. Quarterman is that she and one of her students, the late Dr. Barbara Turner, discovered a population of the Tennessee coneflower (*Echinacea tennesseensis*) in a middle Tennessee cedar glade in 1969; the species was thought to be extinct, thus accounting for the great excitement upon its rediscovery. One of Dr. Quarterman's Ph.D. students, Dr. Thomas Hemmerly, studied the ecology of this coneflower for his dissertation research. Dr. Quarterman worked hard to help educate the public about the significance of this federally endangered cedar glade endemic and served on committees to plan for its protection and recovery; the species was delisted in 2011. Now, many people in Tennessee can recognize the Tennessee Cone Flower and have come to appreciate it – a fine and fitting tribute to the lady who loved the "flower gardens" of the cedar glades and spent many years educating people about the wonders of plants and of the necessity of preserving their habitats.

Carol C. Baskin
Department of Biology
Department of Plant and Soil Sciences
University of Kentucky, Lexington, KY

Jerry M. Baskin (retired)
Department of Biology
University of Kentucky, Lexington, KY

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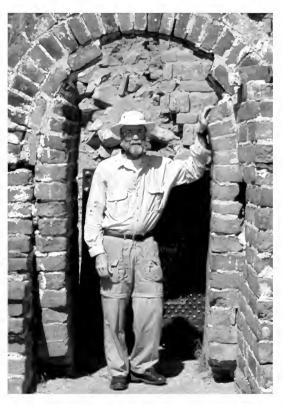
Dr. Elsie Quarterman Photograph courtesy of the Quarterman family.

OBITUARY

Edward Calvin Swab January 19, 1944—May 20, 2013

Edward Swab died at his home from complications of lymphoma and leukemia. He was born and received his early education in the Pittsburgh, Pennsylvania area. After receiving a BS degree in Chemistry and Physics from Clarion State University, he was drafted into the U.S. Army and served in Vietnam. After discharge, he worked as an analytical chemist for the Pennsylvania State Liquor Control Board.

Ed met Janice Coffey on a 1985 trip to Peru, retired from his job, and moved to North Carolina, where they were married in 1986. He earned an MS in Botany from North Carolina State University and worked in North Carolina as a field biologist largely for environmental consulting firms. He loved all of nature; of the living world, birds were his



great passion, followed closely by plants and insects, although no creature escaped his notice. He was highly conversant in astronomy and geology. His prized possessions were the books in his library on all nature subjects.

Travel was a priority because there was so much to see in the world! A journal for taking notes, binoculars, a camera, and field guides were daily necessities. The ASB has lost a member who reminds us that the natural world is not only to be studied but ardently loved. Photograph shows Edward Swab on the Great Wall of China in 2008.

Obituary obtained from Edward Swab's widow Janice and supplied by Dr. John M. Herr, Jr., Department of Biological Sciences, University of South Carolina, Columbia, SC, and by Dr. Lisa Ann Kelly, Department of Biology, University of North Carolina, Pembroke, NC.

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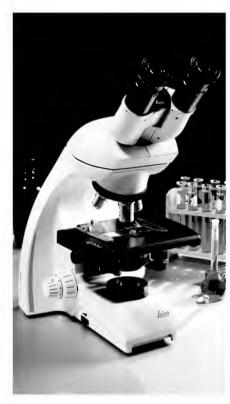
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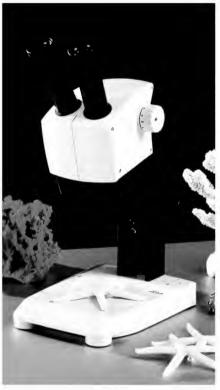
More information about SAFC may be obtained from their web site at http://www.safc.org, and by e-mail at safc@safc.org. The mailing address is Southern Appalachian Forest Coalition, 46 Haywood Street, Suite 323, Asheville, North Carolina 28801-2838. The telephone number is (828) 252-9223.cs

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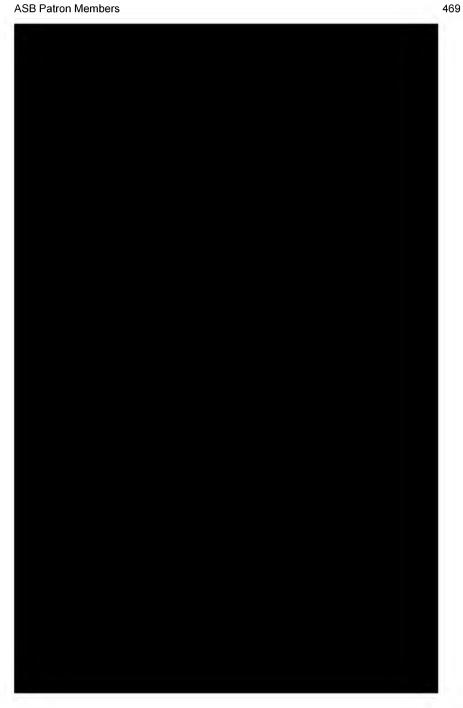
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